The Electrical Industry's Weekly Magazine

May 12, 1958

Electrical World

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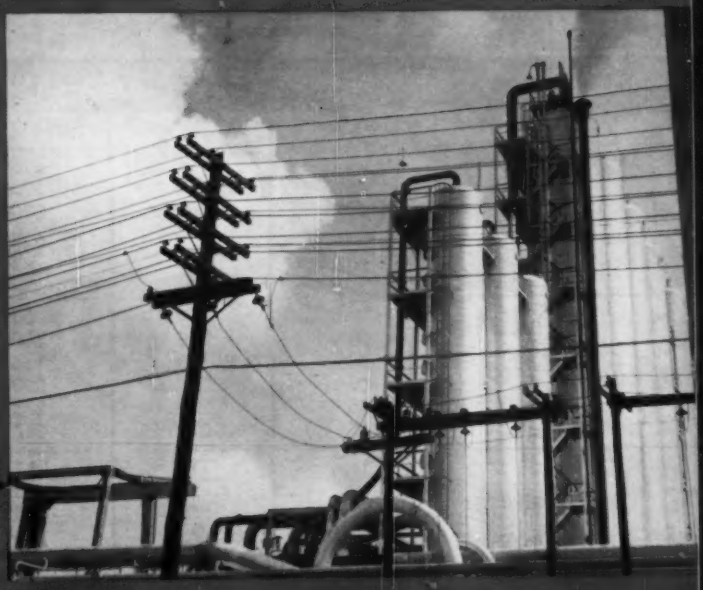
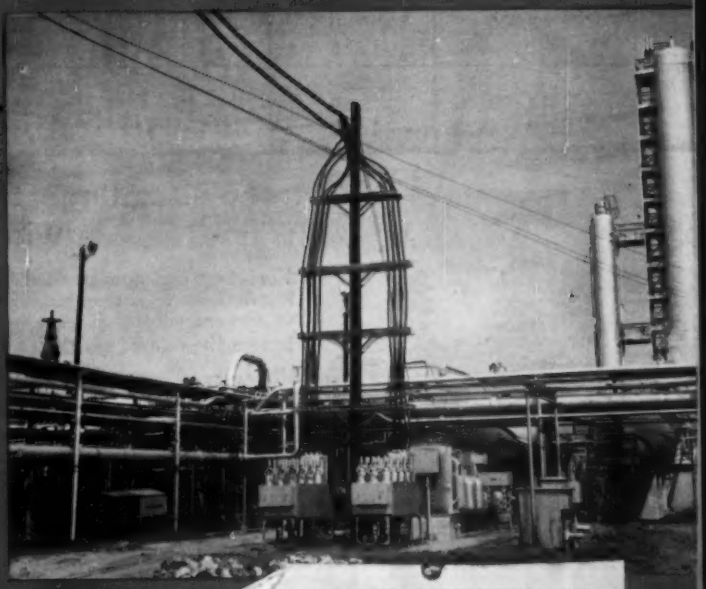
A McGraw-Hill Publication

Refinery Distribution Problem Solved:

Open Wire Replaced by Aerial Cable

. . . . . page 59





TVA: After 25 Years, Still an Issue . . . page 55

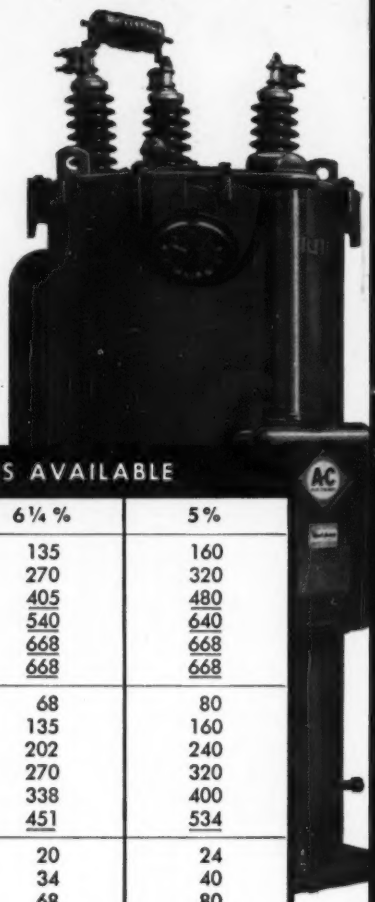
E B POWER GS W
UNIVERSITY MICROFILMS I
313 N 1 ST
ANN ARBOR MICH

Allis-Chalmers—25 Years of Leadership in 5/8% Regulators

now... *Vari-Amp Ratings*

to 668 Amperes on Allis-Chalmers

distribution voltage regulators



RATING		RANGE AND CURRENT RATINGS AVAILABLE				
VOLTS	KVA	10%	8¾%	7½%	6¼%	5%
2,500	25.0	100	110	120	135	160
	50.0	200	220	240	270	320
	75.0	300	330	360	405	480
	100	400	440	480	540	640
	125	500	550	600	668	668
	167	668	668	668	668	668
5,000	25.0	50	55	60	68	80
	50.0	100	110	120	135	160
	75.0	150	165	180	202	240
	100	200	220	240	270	320
	125	250	275	300	338	400
	167	334	367	401	451	534
7,620	11.4	15	17	18	20	24
	19	25	28	30	34	40
	38.1	50	55	60	68	80
	57.2	75	83	90	102	120
	76.2	100	110	120	135	160
	114.3	150	165	180	203	240
	167	219/241	241/265	263/289	296/326	351/386
	250	328/361	361/397	394/434	443/487	525/578
13,800	34.5	25	28	30	34	40
	69.0	50	55	60	68	80
	138.0	100	110	120	135	160
14,400	36.0	25	28	30	34	40
	72.0	50	55	60	68	80
	144.0	100	110	120	135	160

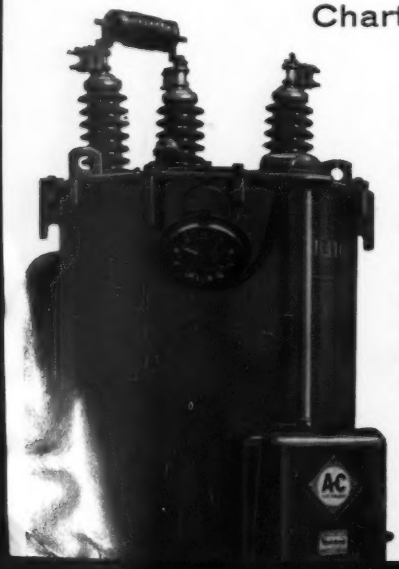


Chart shows ratings to 668 amperes with 21 new *Vari-Amp* ratings

Vari-Amp can now be used to increase regulator capacity (while decreasing range of regulation) to a maximum allowable current of 668 amperes or 160%. This new development results in increased applications for distribution regulators and further lowers the cost of regulation.

You now get as much as 50% increased kva capacity on 21 different ratings of Allis-Chalmers ⅝% step regulators.

These new load-carrying capabilities have been tested in actual field service for four years and many of the new ratings are in stock for immediate shipment. Behind this announcement is the continuous development program that has maintained Allis-Chalmers design and operational leadership during the past 25 years.

For details, contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

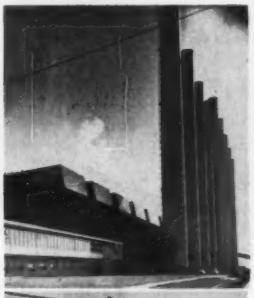
A-5751

Electrical World

Vol. 149, No. 19 MAY 12, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue



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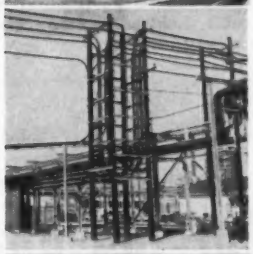

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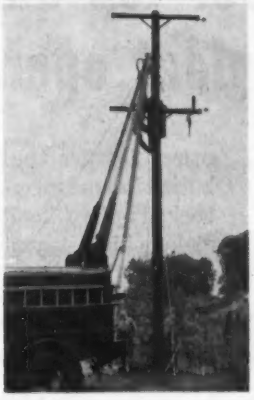

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CURRENT EVENTS

TVA: After 25 Years, Still An Issue

Nation's biggest power producer awaits action on self-financing, confirmation of directors on anniversary.....p 55

DISTRIBUTION

Equipped Small Crews Effective

George W. Peak, Public Service Co of Indiana

Hydraulic derrick, mechanical digger make 3-man line crew more efficient and economical than larger one.....p 67

GENERATION

Pump Storage Units To Fit System Conditions

H. H. Roth, Allis-Chalmers Mfg. Co

Pumping hours available, peaking power required, and method of starting as pump must be considered.....p 72

Compare Nuclear Plant Auxiliaries

V. H. Simon, Pioneer Service & Eng. Co

Tabulation compares auxiliaries of five reactor types with each other and coal fired plants.....p 62

INDUSTRIAL

Refinery Conquers Open Wire Congestion

M. L. Watts, Humble Oil & Refining Co

Changeover to aerial cable also alleviates corrosion, and reduces hazard from cranes used in maintenance work....p 59

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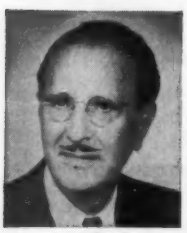
Soggy land and heavy reels of Okonite Cable presented a rugged installation problem. But by digging a 4-foot trench, and by "putting the Cat before the truck before the float," Guarantee Electrical Co. laid down two cables simultaneously at three miles per hour. Cables were a 15kv, 3-conductor Okolite-Okoprene submarine power cable and a 24-conductor Okolite-Okoprene submarine control cable designed to assure the continuous water supply essential to plant operation.

"We specified Okonite because...

This tough installation called for top-quality cables to assure continuous plant operation"



"Demanding assignments are 'our meat'," says Arthur Kaspar, Chief Electrical Engineer of Guarantee Electrical Company of St. Louis. "A good example is our recent cable installation for a large plant here in Missouri.

"Our client specified a never-failing, 24-hour-a-day, controlled source of plant water. The best pumping station site was miles from the plant, in low-water marsh land subject to periodic flooding from the Mississippi River—up to 25 feet above river level. One thing was certain . . . this called for really dependable cables for power and for control of the complex pumping station that would supply the water to the plant.

"Another thing was certain, too . . . this was a job for Okonite. Our experience has taught us that Okonite gives maximum insurance and value where dependability in vital circuits is concerned."

Conferences between Mr. Kaspar and Okonite developed the proper cables: unaffected by water, highly resistant to soil conditions and other factors that attack *any* buried or submerged cable, and backed up by Okonite's 78 years of making highest-quality cable.

* * *

For your vital circuits, take a tip from Mr. Kaspar and other leading electrical engineers and specify Okonite. Whatever the installation, when you talk to Okonite you'll get an unprejudiced recommendation for your cable needs because Okonite, *and only Okonite*, makes cable by all four insulating methods: strip, dip, extrusion and taping. The Okonite Company, Passaic, New Jersey.

5248

where there's electrical power...there's **OKONITE CABLE**

Congratulations

American Electric Power Company, INC.

Electrical World congratulates a distinguished company on adopting a distinguished name . . . The American Electric Power Co . . . effective today. For 30 years The American Gas and Electric Co has been operating straight electric. During these years, AG&E has been a leader in pushing ahead into untried areas of power production, transmission, distribution, and utilization. The name, American Electric Power Co, gives them a franchise of inestimable value. AEP should be proud that it fell to their lot to have American as part of their name. The company is truly American in its philosophy and its objectives. May the new name become an objective rather than a title and set the stage for even greater accomplishments in the promotion of the electrical way of life.

Fischer Black

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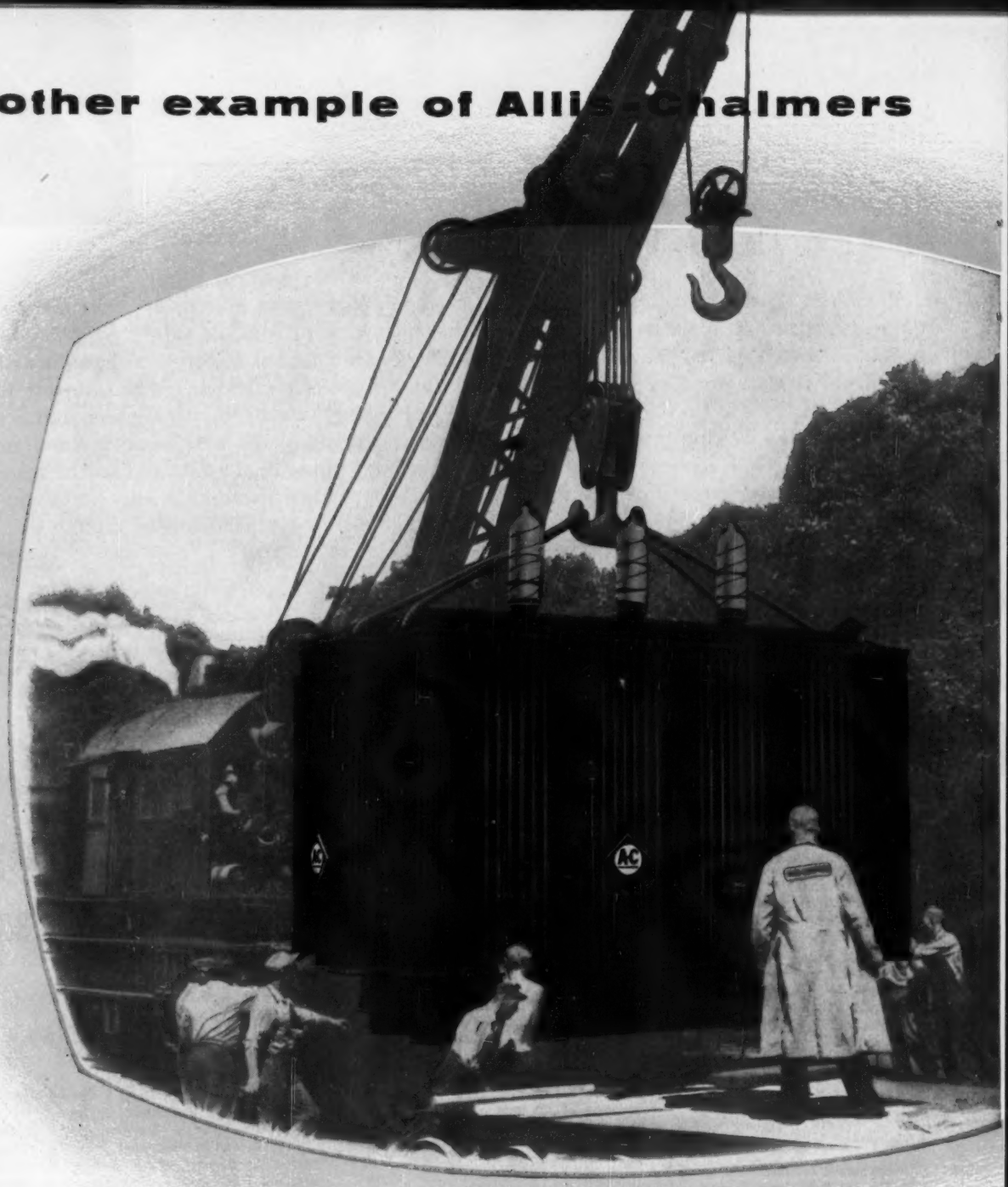
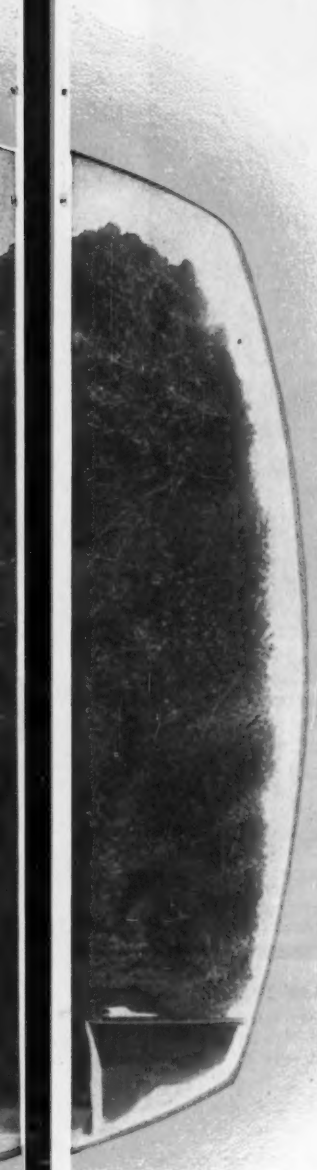
Another example of Allis-Chalmers



Balanced Design Once an Allis-Chalmers transformer is on the line, you can look forward to years of extra dependable service because *Balanced Design* includes: *Corona-Free* insulation, high impulse strength, uniform cooling, high short-circuit strength, weather-tight construction . . . and many other superior features. Ask your A-C man for all the details, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

Welded-on radiators are pressure-tested at the factory. Bushings are also installed at the factory to reduce installation time.

leadership in transformers



Large factory-assembled transformers moved from train into position and...

on the line in less than 4 hours

A. J. Becker
Field Engineer

"MANY engineers are pleased to learn how quickly large power transformers can be installed. When you check the timesaving features of Allis-Chalmers transformers, the reasons for fast and easy installation become obvious."

Factory assembly where shipping clearances permit is one important reason. Factory-installed radiators and bushings leave nothing to be done at the site except grounding the tank, connecting high and low voltage bushings, and completing system electrical test checks. Building transformers as large as 20,000 kva using this construction has become routine at Allis-Chalmers.

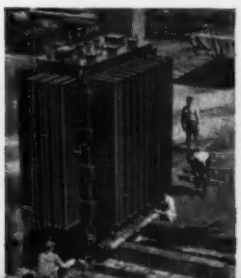
Ski-base helps save time also. It permits rolling or skidding in any direction. Turned-up ski ends ride smoothly on all types of rollers without gouging or digging in. Eyeholes in the corners of the base make winching into position easy. Corner jack lugs are designed with ample clearance, and are clear of cooling tubes.

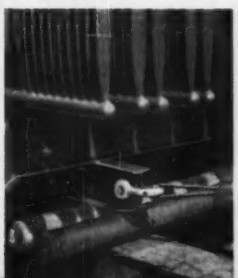
Another reason behind fast installation is the nation-wide staff of experienced Allis-Chalmers field engineers... like A. J. Becker, with 36 years of experience inspecting, testing and installing A-C transformers. These men *know* transformers. They offer on-the-spot guidance to make installation smooth and quick.

A-C ALLIS-CHALMERS

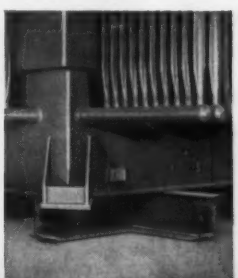
A-5694

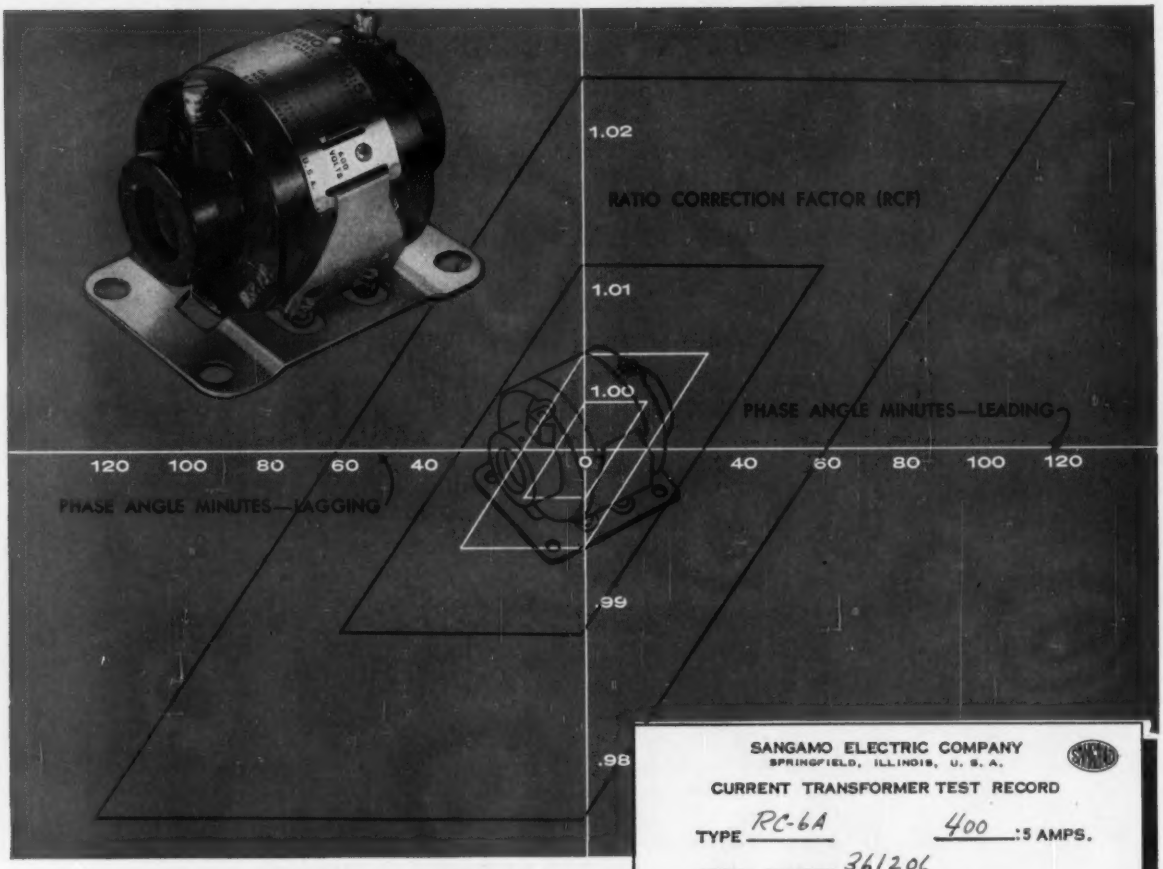
Ski-shaped base of heavy I-beam cross supports permits moving in any direction. Reinforced clevis hole gives extra tow strength.





Ample jacking clearance and working space plus broad, flat surfaces for lifting jacks save hours of installation time.





SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS, U. S. A.

CURRENT TRANSFORMER TEST RECORD

TYPE RC-6A 400 :5 AMPS.

SERIAL NUMBER 361206

TEST MADE AT 60 CYCLES

SECONDARY BURDEN	10% RATED CURRENT		100% RATED CURRENT	
	R C F	PH. ANGLE MINUTES	R C F	PH. ANGLE MINUTES
B-0.2	1.0014	+4	1.008	+2

40283

DATE 3/31/58

SANGAMO CURRENT TRANSFORMER TEST CARD
This is the Sangamo Customer's Record of Factory Test that is now supplied with all Sangamo Current Transformers. It's your assurance that Sangamo Type R Transformers hit the bull's-eye for accuracy every time.

SANGAMO Type R TRANSFORMERS

"tailor-made" to fall within 0.3 accuracy class

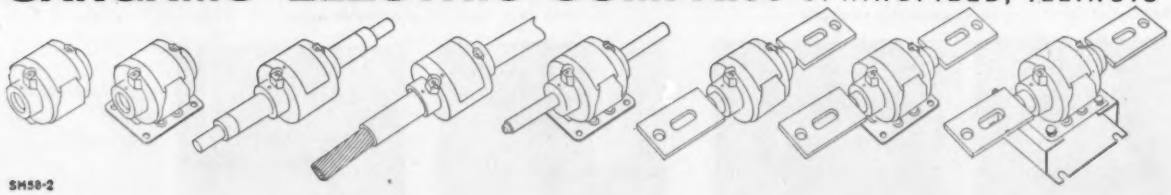
You don't have to worry about accuracy when you specify Sangamo Type R Current Transformers. These transformers are designed to consistently meet the 0.3 A.S.A. Standard Accuracy Classification for B—0.1 and B—0.2 burdens.

Type R Transformers are light enough to be supported by the primary conductor alone. They are encased in a high impact phenolic shell, filled with a thermo-setting plastic that eliminates voids and seals moisture out of the core or windings.

These transformers, in the eight variations sketched below, give your engineers unusual freedom in devising simple, cost-cutting installations to meet growing needs.

Ask your Sangamo Representative or write us for Bulletin 501 for detailed information as to how these economical transformers can provide flexibility on your system.

SANGAMO ELECTRIC COMPANY SPRINGFIELD, ILLINOIS



SM58-2

This guy is growing fast!

Born just last year, the new Copperweld* Type M Guy Strand has become the fastest growing guy in the field. Men in the telephone, power, and railroad industries have helped it grow. They have welcomed Type M to their immediate family of products, and with it has come real economy. It sells at new low prices, thanks to Copperweld research and new production techniques. And it saves in yearly maintenance since Copperweld requires no upkeep—a fact long established.

Convenience is another quality of Type M. Pliable and easy to handle—it can be readily bent, served, moused or clamped. Write us today for complete information regarding the advantages of Type M and add it to your family of products now.

*trademark

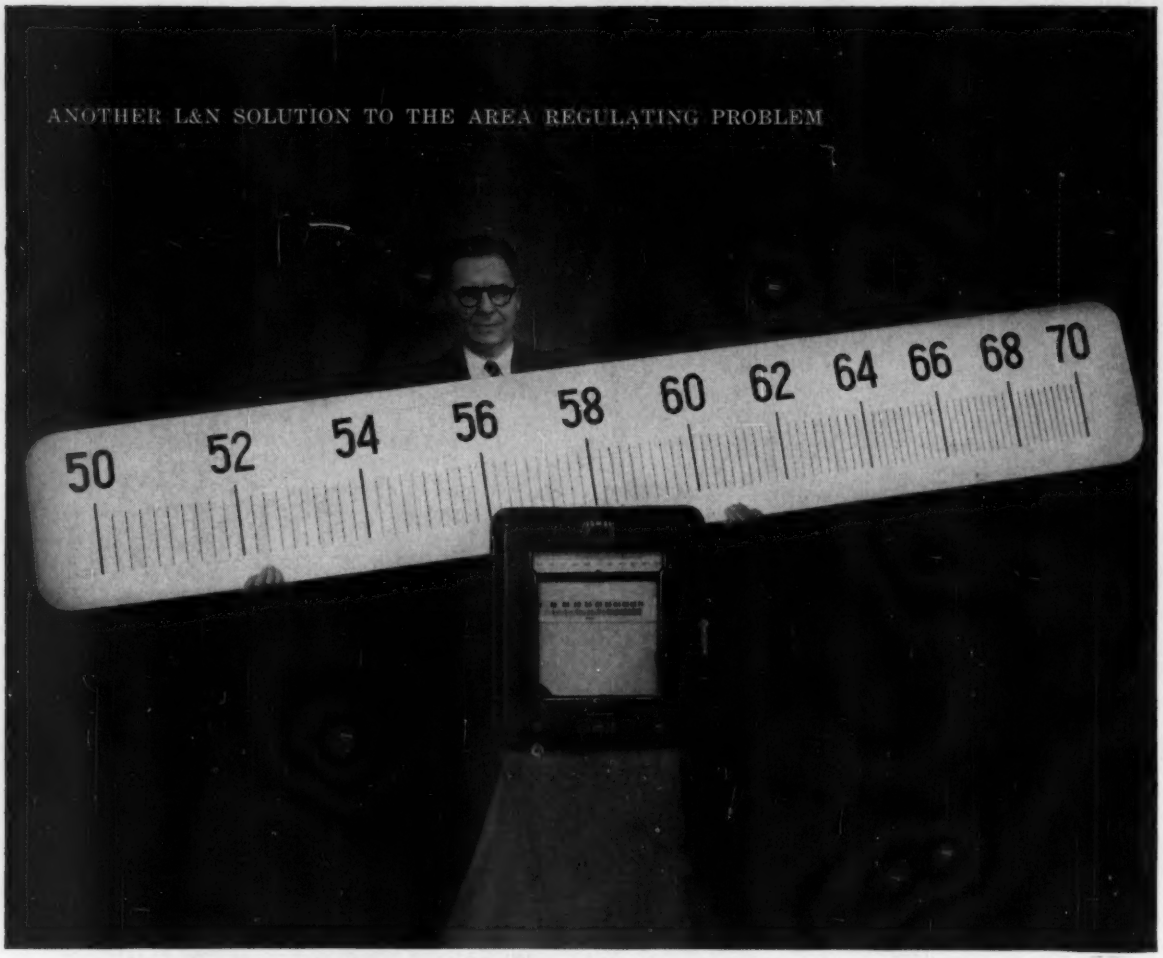
COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Copperweld TRADE MARK

TYPE M GUY STRAND



T. H. Bean, L&N Load-Frequency Control Specialist, holds mock-up of an eight-foot-wide scale which would be required on a single-range, 50-70 cycle frequency recorder to provide desired readability near 60 cycles. The new Speedomax® Dual Range Recorder gives required legibility by utilizing dual ranges of 59.5 to 60.5 cycles, and 50 to 70 cycles, nominal.

New Dual-Range Frequency Recorder Combines ±½ & ±10-Cycle Scales

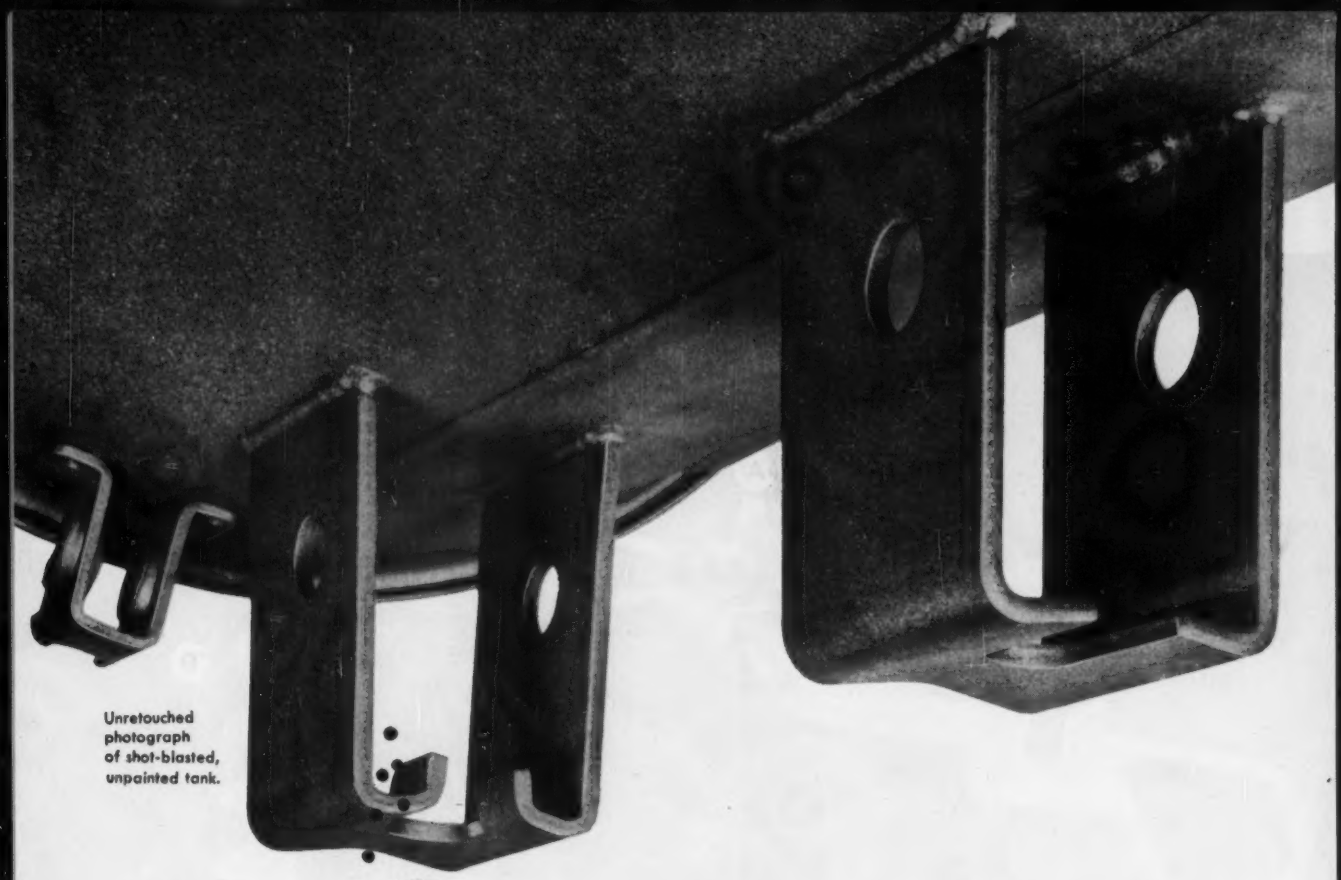
By T. H. Bean, Leeds & Northrup Company

• Power system operators have long regarded the ideal frequency recorder as one which would make even 0.006-cycle swings easily discernible, and at the same time, accommodate emergency frequency excursions ranging from 50 to 70 cycles. New L&N recorders combining these characteristics are now in operation on several power systems.

The new recorders (Speedomax Type G) operate on a narrow, ±½-cycle scale under normal conditions so that an 0.1-cycle bandwidth covers a 1″ segment of the chart. Whenever a system upset drives frequency beyond the narrow range, the instruments automatically transfer to the wide, 50-70 cycle range.

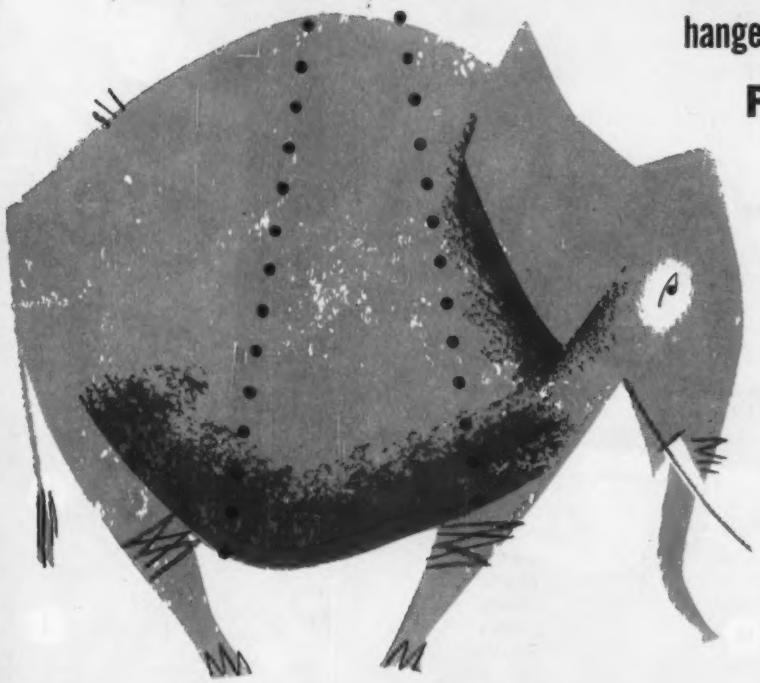
Use of a Wein bridge in the measuring circuit provides inherent stability without the need for separate, external primary elements. The new recorders are designed with ample reserve balancing torque to accommodate control devices, making them well suited for integration with planned, or existing, load-frequency control systems.

To get all the facts, we suggest you talk with the men at your nearest L&N District Office, or write to 4938 Stenton Avenue, Philadelphia 44, Pa., and ask for Preliminary Technical Publication 461-32.



Unretouched photograph of shot-blasted, unpainted tank.

to keep the transformer on the pole . . .



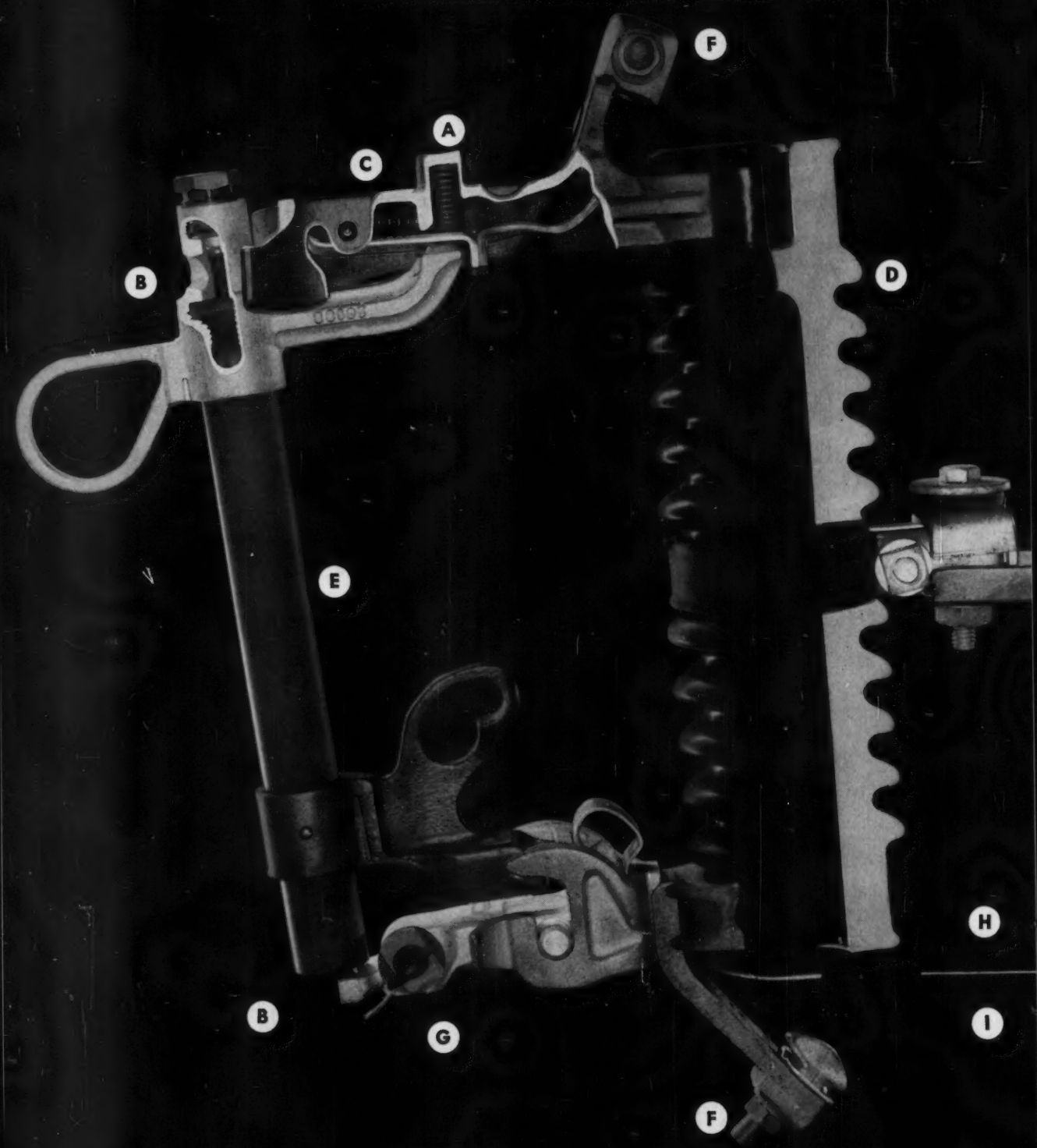
hanger brackets of Pennsylvania **POLE STAR** distribution transformers are hand-welded completely around the bracket flange. No crevices are left that might remain unpainted and where rust-producing moisture can collect.

McGRAW EDISON

PENNSYLVANIA TRANSFORMER DIVISION
McGraw-Edison Company • Canonsburg, Pa.

POLE STAR

For full range fault protection...



specify KEARNEY Type "G" Cutouts

Extensive, rugged, field operating tests prove that the Kearney Type "G" Cutout provides full protection throughout the complete range of fault currents—without use of adaptors or gadgets.

Study the advanced features that make these extra heavy duty cutouts your most logical choice for line fusing, transformer and capacitor protection.

Ask your Kearney representative to explain fully why you can count on Kearney Type "G" Cutouts for superior construction, thorough dependability and unfailing protection.

Check These Advanced Features

- **A** Full Floating Contact—stainless steel spring absorbs upward thrust, maintains contact pressure until arc is extinguished.
- **B** Gas Vents—double vent action minimizes internal gas pressure.
- **C** Horizontal Stainless Steel Spring—helps absorb recoil during fault interruption, takes shock when closing cartridge.
- **D** Insulator—designed for strength and lightness, barrier prevents internal leakage.
- **E** Cartridge—½" bore assures positive interruption of low faults; extra strength tube withstands pressure of high currents; accepts universal fuse links; no need for adaptors and other gadgets.
- **F** Terminals, Plated T-Lug Design—for use with all types of conductors.
- **G** Flipper—whip action provides 4" travel in separating blown fuse link.
- **H** All live parts non-ferrous or stainless steel.
- **I** Can be field or factory equipped with link break attachment.

JAMES R. KEARNEY CORPORATION • 4224-42 Clayton Avenue • St. Louis 10, Mo.

FOR BETTER CONSTRUCTION—SAFER MAINTENANCE

Specify Kearney Products

Plants at: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

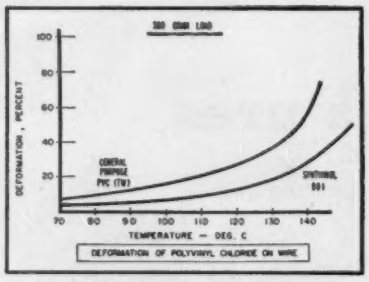
ADVERTISEMENT

An unusual polyvinyl chloride compound

CURRENT TRENDS

No. 10 in a series of articles

Polyvinyl chloride (PVC) compounds have been widely used in the wire and cable industry. These compounds have many useful properties and have found wide application as insulations and sheaths. These properties and applications were discussed in Current Trends No. 4, entitled "Progress Report on Polyvinyl Chloride Insulations." Like most materials, the conventional PVC compounds have limitations, and there are many applications where these weaknesses have prevented taking full advantage of the good features. This discussion is about a special PVC compound, which was designed and developed in an effort to incorporate into a single compound as many desirable properties as possible. Known as Synthinol 901, this compound was developed in the laboratories of the Rome Cable Corporation, Rome, New York. Today Synthinol 901 is being used as insulation and sheath for wires and cables in many applications where conditions of installation or use require properties not to be found in conventional PVC compounds.



Graph shows heat deformation vs. temperature, and compares Synthinol 901 with conventional Type TW compounds. Test run in accordance with Underwriters' Laboratories standard procedure, except for temperature.

Shortly after World War II, the Underwriters' Laboratories established the need for a PVC insulated wire suitable for wiring appliances where an operating temperature rating of 105 C was required. Rome Cable laboratory attacked the problem of developing a PVC compound to meet U/L requirements. The laboratory was also given a list of desired additional properties for incorporation into this compound. This project assignment was completed in 1949, at which time Rome Cable introduced Synthinol 901. Since 1949 this compound has provided the solution to a rather impressive list of tough wiring problems.

True, there are many 105 C PVC compounds available today; there are likewise compounds available which possess one or more of the individual properties on the list describing Synthinol 901. What is unusual is that here, for the first time, was a single PVC compound which possessed all of these superior properties and which also retained all of the properties found in conventional PVC materials.

Rather than presenting data and charts, it is believed that the practical value of this compound is better illustrated by relating a few of the concrete results of eight years of continuous work with users who have had difficult problems. These case histories are all a matter of record.

1. Oil refinery, industrial and chemical plant wiring.

Plant and oil refinery engineers had long used Type TW for plant wiring. Results were good, but too often the heat deformation characteristics of conventional TW caused trouble in warm locations. Since one of the outstanding properties of Synthinol 901 was its superior resistance to deformation, this material was tried, and soon became widely used because of its much better record in service. During several years of experience Synthinol 901 proved to have chemical and solvent resistance so superior to conventional materials that it came into wide use where this resistance was needed. In these industrial applications, which are not under the jurisdiction of the National Electrical Code, the higher temperature ratings have made possible appreciably higher current carrying capacities, with consequent savings.

In chemical plant wiring the corrosive action of chemicals and solvents has always been a tough problem. Although PVC has inherently better resistance to chemicals and solvents than many other materials, engineers desired further improvement. One user ran a series of long time tests with samples immersed in various solvents, acids, and alkalis. The results clearly showed that Synthinol 901 would give longer life than other PVC compounds, when exposed to these chemicals.

2. Oil-filled transformers.

Transformer engineers have long been searching for a cable construction to replace the varnished cambric-insulated cable used for high voltage and tap changer leads in oil-filled transformers. One transformer manufacturer, encouraged by successful experience with Synthinol 901 in other applications, began a comprehensive study of this insulation in lieu of VC on these high voltage leads. In operation these leads are immersed in the transformer oil at elevated temperatures. This test program extended over several years, and included evaluation of almost every conceivable effect of Synthinol 901 on the life and performance of the transformer. These engineers came up with the following reasons for standardizing on Synthinol 901 for this application:

1. There was less sludge in the oil than when VC insulation was used.
2. There was no harmful degradation of electrical properties of the oil.
3. Conductors ran cooler when insulated with Synthinol 901, permitting a 7% increase in current rating of the lead cables.
4. The use of Synthinol 901 in lieu of VC afforded substantial dollar savings.

3. Coil Leads.

Many manufacturers of small coils for use in electrical and electronic components had tried for years to use PVC insulated lead wires in their manufacturing operations. These coils, with leads attached, are put through a varnish or wax impregnation followed by a baking cycle. The baking cycles may be as long as 16 hours at temperatures as high as 105 C. In a great many of these cases PVC insulated lead wires had given trouble due to shrinkage, cracking, and stiffening during the impregnation and subsequent baking. Here is an application where Synthinol 901 has been doing an almost faultless job. After nearly eight years of wide usage, there has been no case of shrinkage, cracking, or stiffening of insulation reported where Synthinol 901 has been used in this application.

4. Panelboard wiring.

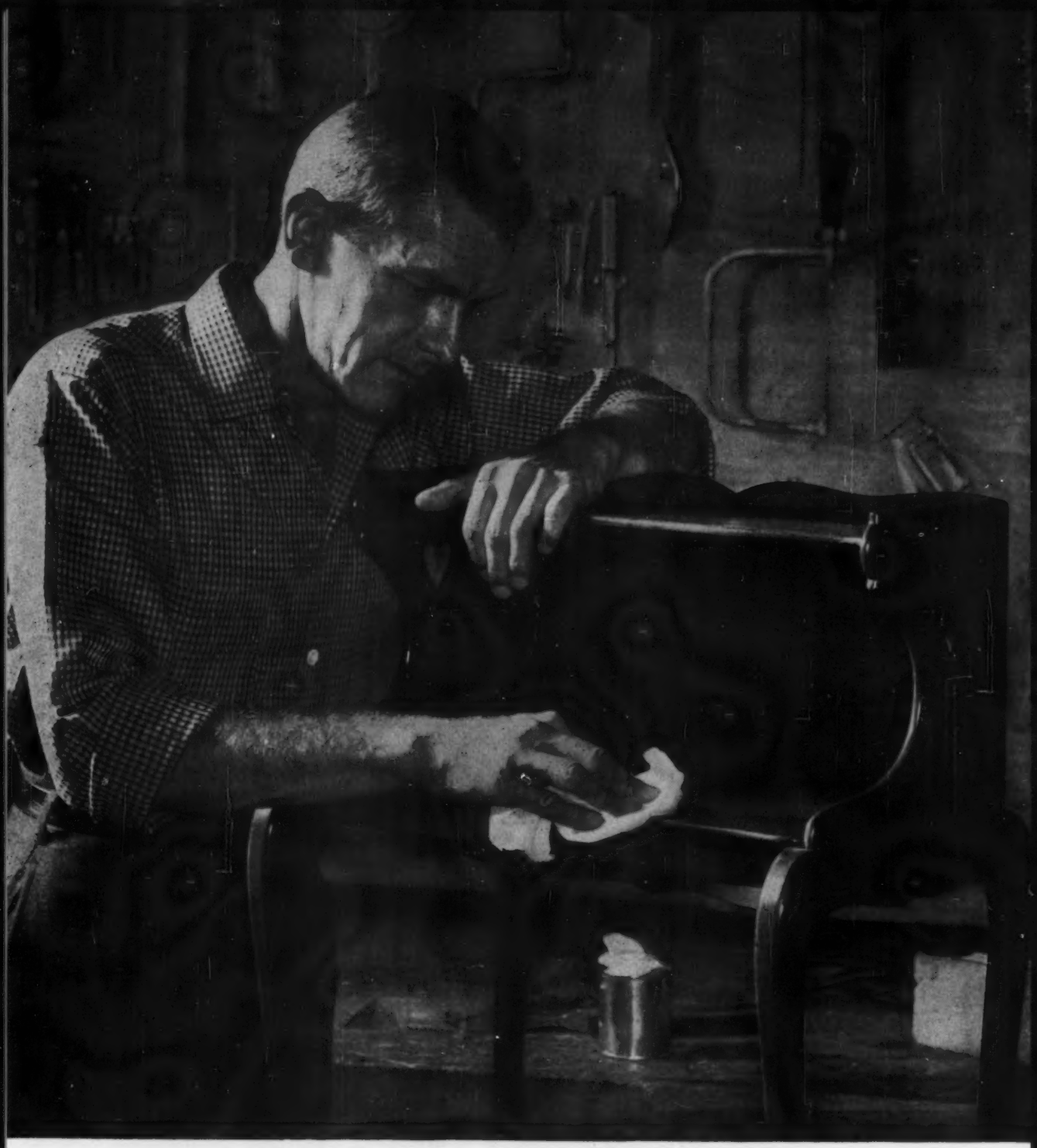
For many years panelboards and switchboards have been wired with Type TA wire. This wire has a layer of asbestos over a primary insulation of PVC. The asbestos has been used as a protection against the heat deformation which was known to occur at sharp bends and points where wiring was held under clamps. Transformer and machine tool manufacturers have found that the superior resistance of Synthinol 901 makes the asbestos covering unnecessary. In this application, for additional safety, the insulation thickness is normally 1/64" heavier than standard. These manufacturers have found Synthinol 901 to be an economical solution to their particular needs.

These case histories are only a few of the applications where this unusual compound has served well. Synthinol 901 has been proven by test and actual use to be superior to conventional PVC compounds in the following ways:

1. Suitable for continuous operation at higher temperatures.
2. More stable under severe heat cycling.
3. Suitable for continuous immersion in hot transformer oil.
4. Superior resistance to chemicals and solvents.
5. Greater resistance to heat deformation.

All of our experience and knowledge in this field is available to you. If you have a wire and cable problem where you think Synthinol 901 might prove useful, why not let us help you?

ROME CABLE CORPORATION, Rome, New York



TIME IS THE MEASURE OF ALL WOOD PRESERVATION

On the job–as on your own time–you know the importance of wood preservation.... The more the statistics accumulate, the more clearly the answer is AMCRECO pressure treatment.

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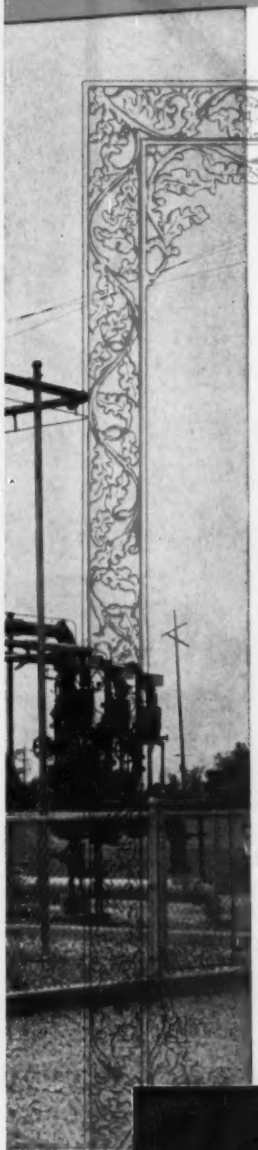
PRESSURE TREATED WOOD PRODUCTS

AMERICAN CREOSOTING CORPORATION LOUISVILLE 2, KENTUCKY
SUBSIDIARY OF UNION BAG-CAMP PAPER CORPORATION

MOLONEY ELECTRIC COMPANY

INSTALLS A MOLONEY 135,000 KVA STEAM-ELECTRIC GENERATING STATION



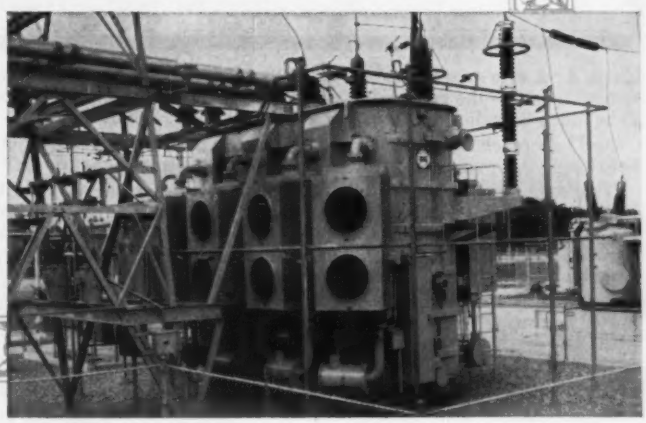
Another Example of Moloney's Abilities and Facilities Working with Utilities to Meet Specific Customer Requirements

The Michoud Station, now in operation, presented problems in the planning stage which required cooperation in the design and manufacture of component equipment. In the case of the transformer, one of the main components in this 13 million dollar plant, New Orleans Public Service Inc., required a 135,000 KVA, three-phase, sixty cycle, class FOA Transformer, H.V. 115,000 GRD. Y/66400 volts and L.V. 13,800 volts delta. It is the main station transformer connected directly to the generator. Customer's specific requirements had to be met in developing the design.

Michoud Station is an important link in the expanding facilities that New Orleans Public Service Inc., must provide to assure its customers of ample, dependable service and Moloney is proud to have furnished a major component of this installation.

MEDO-12

Your nearest Moloney representative will be glad to explain in detail how Moloney can supply any size transformer you may require. Contact him today.



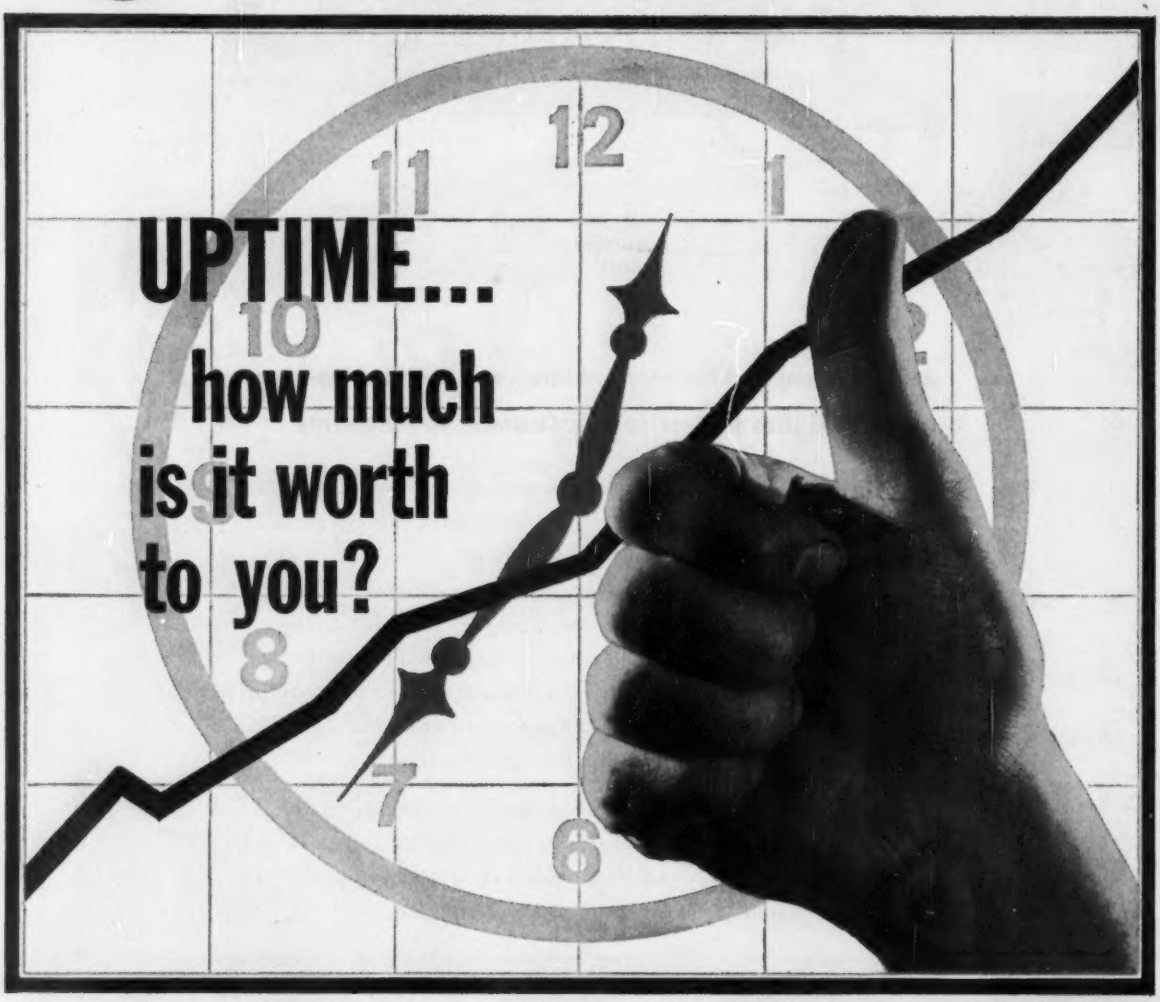
MOLONEY ELECTRIC

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA
SALES OFFICES IN ALL PRINCIPAL CITIES

US RUBBER PACKING

UPTIME... how much is it worth to you?



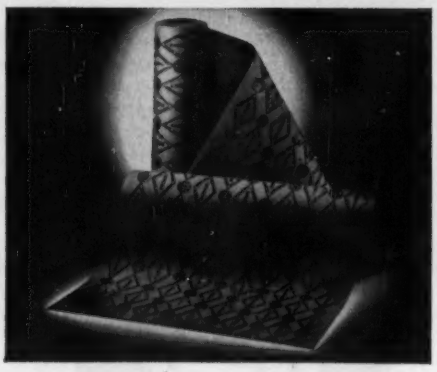
These days, everyone talks about *downtime costs*. Few consider how much *uptime is worth*—the great majority of time when production runs smoothly. How much is uptime worth to *you*, each hour? $100—$200—$300?

And how much are you willing to spend each hour for a packing that will help keep your pumps and flow lines maintenance free? 1¢—2¢—5¢?

That's the kind of money involved when you use a packing like U. S. Rainbow®—first in red sheet packing. Each extra hour of production uptime means hundreds of dollars in production, yet those same extra hours of packing uptime can be had for just pennies... the difference in cost between a quality packing like U. S. Rainbow and ordinary packings.

Rainbow is designed to pack flanges or other parallel surfaces against hot or cold water, air, saturated steam (up to 150 lbs.) and many other hydraulic conditions—and to pack them for longer hours of *uptime*.

U. S. Rainbow is one of a complete line of quality industrial packings available at your local "U. S." Distributor, or by writing us at Rockefeller Center, N. Y. 20, N. Y. In Canada, Dominion Rubber Co., Ltd.



US RUBBER Mechanical Goods Division

United States Rubber

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The Electrical Newsletter

FUTURE NEWS ▶ **A break in farm wiring bottleneck may be in offing.** REA is thinking of permitting co-ops to install and capitalize members' panelboards and house wiring as a part of co-op distribution system.

Look for more resignations of key staff members of AEC.

LATE NEWS ▶ **Iowa-Illinois G&E loses fight to stop an REA loan** to Central Iowa Power Co-op for building lines to a factory in G&E's service area. U. S. Supreme Court let adverse lower court ruling stand. Doctrine: Economic injury is no ground for private utility's suit.

Sen Wayne Morse blasts administration's "negative action" as he keynotes 15th annual American Public Power Assn convention. The Oregon Democrat charges administration with "no plan for power and expansion except to block and veto," seeks a large reactor at Hanford, Wash., and urges overhauling Atomic Energy Act.

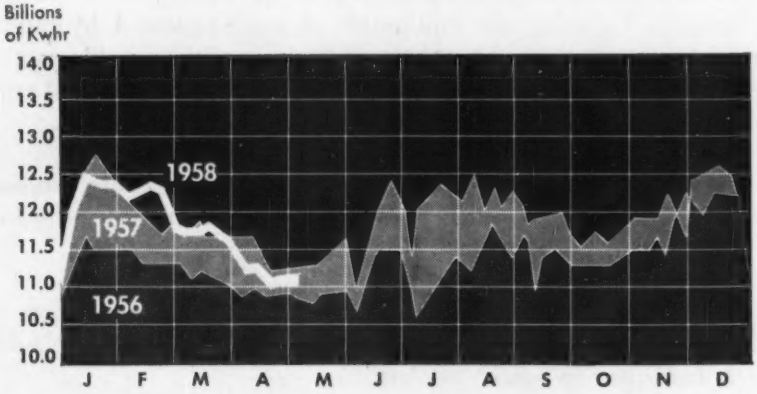
A corporation charter that may mean a new electric utility in Arkansas is filed in Little Rock. Named Arkansas Louisiana Chemical Corp, it is set up mainly to finance building a chemical plant (natural gas products). But charter also permits the firm, among other things, to own and distribute natural gas and electricity.

American & Foreign Power is suspending work on its proposed Latin American atomic power units. Reason: High cost in comparison to conventional plants, and inability at this time to get necessary insurance coverage against a nuclear accident.

There's a new child in the NEMA family—it's the newly formed section for manufacturers of room air conditioners.

Management changes . . . Kansas City P&L elevates R. K. Zimmerman to VP-sales, area development, and customer services.

***POWER OUTPUT*—Down 0.3%** (Week ending May 3), Kwhr 11,251,000,000



Per Cent Change From Previous Year

	Apr 19	Apr 26	May 3
Total U.S.	−3.3	−0.9	−0.3
New Eng.	+1.3	+1.8	+3.0
Mid. Atlantic ..	−2.3	+0.1	+0.7
Cent. Ind. ..	−6.2	−4.0	−3.2
West Cent. ..	−0.6	+2.7	+2.5
Southeast	−1.6	−0.5	−0.8
South Cent.	−1.4	+0.5	+6.3
Rocky Mount...	−0.8	+2.1	+2.1
Pacific			
NW	−8.1	−3.9	−6.6
SW	+3.9	+3.3	+2.3

Seasonally Adjusted Index 226.3
Week Ago 223.9 Year Ago 226.7

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World Estimate). Excluding AEC, Output decrease was 0.6%.

A TWO-MINUTE PREVIEW OF THIS ISSUE

EVENTS ▶ **Alabama Power marks two milestones in utility progress** in groundbreaking ceremonies for $121-million Weiss Dam on the Coosa River. First, it's the first utility to begin full development of a major river. Second, the Coosa is the first river to be de-authorized for federal development in favor of private enterprise (p 52).

The many-hued spotlight focusing on TVA on its 25th anniversary brings into clear view the various controversies which have characterized the agency from its very beginning. The key issue—federal vs. private power—has magnified as the agency grew and assumed more functions and responsibilities. What does the future hold in store? For a penetrating, many-dimensional picture of TVA's problems and progress, see p 55.

ATOMIC PROGRESS ▶ **AEC unveils three more basic methods** which may lead to production of electric power through controlled thermonuclear fusion (p 54).

INDUSTRIAL DESIGN ▶ **Want to wage war on those double demons, congestion and corrosion?** Your plan of attack might include use of aerial cable distribution, corrosion-resistant hardware, and compression connectors. This method, now being used at Humble Oil & Refinery Co in Texas, has helped to reduce the congestion of the earlier open wire circuits. Frequency of inspections has also been reduced by installing stainless steel and bronze hardware (p 59).

GENERATION ▶ **How can you determine the best possible pump storage unit** for your system? The choice must be made only after careful study, because close coordination between electrical and hydraulic units is an absolute must. Such factors as the generator and motor ratings, pump-turbine torque requirements, power characteristics of a unit, and pumping capacity must all be considered in designing pump storage projects. For an analysis of these and other important factors, see the story by H. H. Roth of Allis-Chalmers on p 72.

DISTRIBUTION ▶ **Two pieces of equipment and three line men are the best combination** for efficient and economical completion of most line jobs, asserts PS of Indiana. By using the equipment—a truck-mounted hydraulic derrick and a mechanical hole digger—the company was able to cut the size of the basic line crew, increase the number of crews, and save about $170,000 a year in crew costs (p 67).

TESTING ▶ **Checking rotation of slide-wire motors need not be a costly process.** A simple, portable tester does the job quickly and inexpensively for Indiana & Michigan Electric at its Tanners Creek plant (p 64).

OPERATING ECONOMY ▶ **Don't scrap damaged cable clamps and nuts!** You can re-use them if you'll follow the salvaging method developed recently by a Duke Power field crew (p 64).

SAFETY ▶ **Electrical shock from 110-v portable power tools can be prevented** with a ground-checking device used successfully by Appalachian Power. Materials to build the device cost only about $7.50 **(p 64).**

INDUSTRIAL ▶ **Is old-fashioned, haphazard wiring stunting your firm's growth?** You may be in the same boat as the Baltimore graphic arts company which was plagued by an inflexible wiring system which restricted production, hampered growth. Now, with a well-planned, modern wiring system, the company can accommodate bigger loads easily **(p 106).**

A manufacturing firm ends an unusual problem—finger marred steel—by installing nine 5-hp heat pumps. Added benefits: cleaner operation and more efficient heating and cooling **(p 106).**

SELLING ▶ **About a ton of grass grows every week, even in winter,** for a dairy farmer in Springfield, Ohio. He does it by combining hydroponics (the science of soilless plant growth) with a 1-hp heat pump. Result: assurance of green grass all year round for his herd **(p 108).**

How does a combination utility sell electric heat? And how does it go about overcoming the objection, "It's too expensive?" See how one utility accomplished both jobs successfully on **p 108.**

NEW EQUIPMENT ▶ **A maximum cable clamping range of 0.86 in. is featured** in a new aluminum distribution quadrant dead end clamp . . . An underground transformer enclosure just introduced can accommodate pole-type transformers in ratings up to 167 kva in the 15-kv class . . . A new cable puller has maximum pull of 1,000 lb at speeds up to 3 mph. The self-powered unit is designed for light distribution circuits **(p 94).**

MANUFACTURERS ▶ **Take a steel rod, cover it with aluminum, and draw it into wire.** What have you got? Alumoweld—a new aluminum-covered steel conductor for use on transmission and distribution lines. It's now being put on the market by Copperweld Steel **(p 82)** . . . Alcoa buys transformer Div of Automation Instruments. Purpose: Application of aluminum foil and sheet strip windings for transformers **(p 91).**

A huge, 625,000-lb, 200,000-kva power transformer, largest ever built by Allis-Chalmers, will soon be on its way to Jersey Central P&L. It will tie in JCP&L and Public Service E&G systems **(p 82)** . . . Westinghouse develops an "inner-cooled" transformer **(p 92).**

PEOPLE ▶ **Ralph Green becomes Missouri PS's new board chairman** and his son, Richard Green, succeeds him in the president's slot . . . Colorado PS promotes M. M. Koch, R. T. Person, and W. D. Virtue to executive VP; O. P. Reed and D. J. Miller to VP . . . At Pacific G&E, S. L. Sibley becomes VP-general manager, and A. J. Swank and H. W. Haberkorn rise to VP's **(p 110).**

Larger electric furnaces will be designed to serve the ever-increasing demands of industry for metal refining and other special purposes. They will also be used to produce such diverse products as mica and man-made industrial diamonds. An unprecedented growth of the electric furnace in the steel industry is predicted for the day when it is no longer limited by the supplies of scrap.—**N. H. Keyser, Battelle Technical Review, March 1958.**

TECHNICAL NOTES

Pressure drop through the gas flues of steam power plants has a direct dollar equivalent. Measured in terms of inches of water, each inch can be capitalized at $40,000 to $80,000.

Maximum efficiency of a steam cycle using a mechanical moisture separator (a method used when only saturated steam is utilized in a nuclear power plant) will be obtained when the separator is located at the proper point between turbine stages. This point corresponds to a pressure on the turbine condition line equivalent to 10% of throttle pressure.

A remote load can be supplied by a gas turbine near the load instead of by steam-generated power over a transmission line. A recent study of the economic choice between the alternative methods indicates a break even point at a transmission length of slightly over 25 miles.

Temperature inversion, a phenomenon that affects the degree of air pollution, usually develops during dark hours from the rapid cooling of the earth's surface by radiation. But inversion can occur during daylight hours from the adiabatic heating of a mass of air which descends from higher altitudes over a large body of water.

FROM EDITORS IN THE FIELD

Savings of 45% in meter reading and billing costs are anticipated by the Hamburg, Germany, utility from charging each customer a fixed amount monthly based upon his estimated consumption for the year. Meter readings once a year will determine whether the customer is to be billed for excess use or credited for overpayment. Experimental application to a 12,000-customer area has shown general acceptance. Additional payments averaging 6.4% were assessed to 41% of the group and credits averaging 6.9% to 59%.

tough

O-B BUSHINGS HAVE EXTRA STRENGTH TO WITHSTAND SHOCKS OF TRANSPORTATION

"BEYOND THE LINE OF DUTY"

Bushings often live the hardest life before you get them. Suspending heavy circuit breaker parts, they may have to endure the shocks of transportation — shocks that can cause horizontal displacement of parts, and that are not normally "in line of duty."

Cores of O-B condenser bushings are wound on advanced modern machinery. They are harder, tighter, much stiffer than customary. This greater stiffness is exploited to provide extra lower-end cantilever strength. Contact points between core and ground sleeve are located at strategic points, so that the core contributes *mechanically* to the bushing, as well as works electrically. Result: a bushing of great strength, for the exceptional as well as the routine demands.

Techniques, such as this, are the natural result of experience bred of nearly 50 years of successful bushing manufacture. O-B condenser bushings are full of them!

You can have any bushing you want on your new apparatus — *providing you express your choice.* Ask for O-B and get the highest possible dependability.

OHIO BRASS COMPANY, MANSFIELD, OHIO

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Easy to

Check!

SIMPLY LOOK AT YOUR OWN OPERATION TO PROVE THAT O-B IS THE BIGGEST BARGAIN IN STATION INSULATION

You probably have all the facts—on your own terms—within easy reach—right now—to nail down the truth about switch and bus insulators. You can find out when they went into service, how many have been replaced, and why. In other words, you can prove what make of insulator has given you the best mileage on your dollar.

Remember, switchgear manufacturers are glad to supply the insulator you choose, *providing you express that choice.* On new switches and unit subs, as well as your own new station construction, specify the insulator that is the best investment *by your own figures*—O-B.

OHIO BRASS COMPANY, MANSFIELD, OHIO

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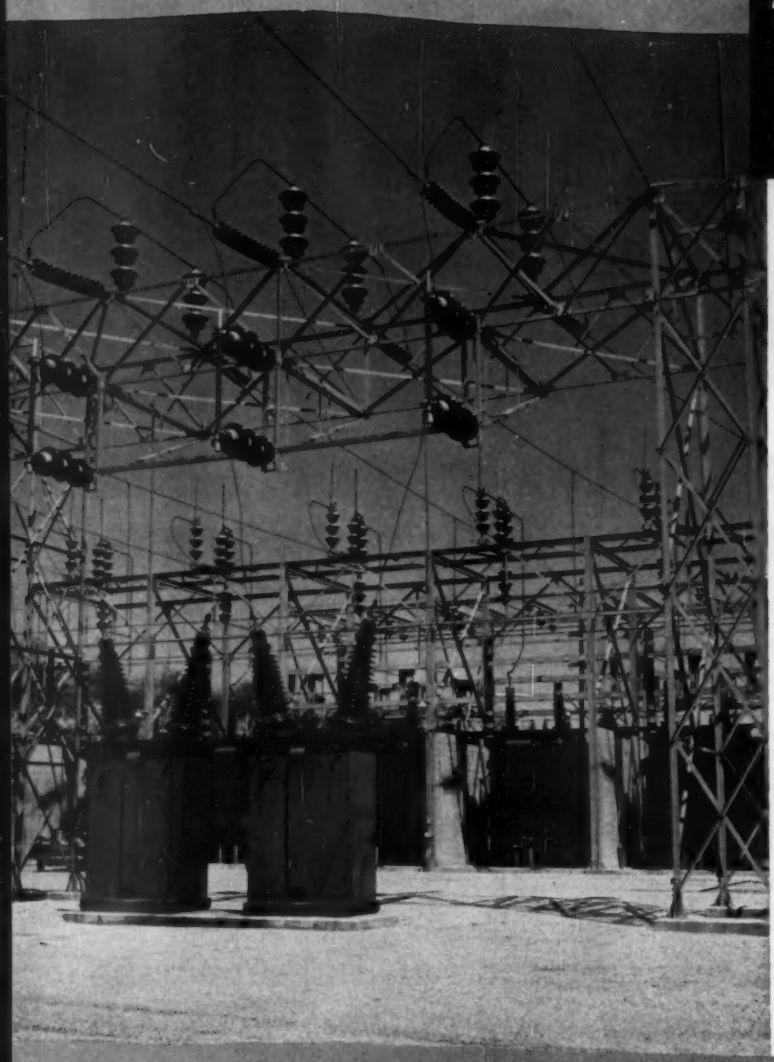
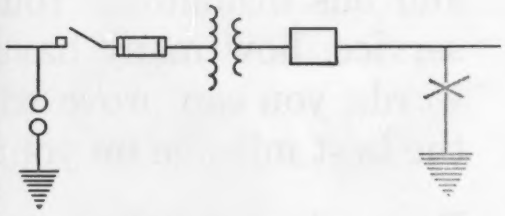
4894-H



Can a primary power fuse "see" line-to-ground secondary faults?...



(Although the data illustrated are for self-cooled transformers, similar tables are available for forced-air-cooled transformers.)

POWER TRANSFORMERS

***TABLE 3 Minimum Ampere Ratings for the Primary Fusing of Three-Phase or Banks of Three Single-Phase Self-Cooled or Water-Cooled Power Transformers**

Nominal System Kv →	23		27.6		34.5		46		69		115		138	
Transformer 3-Phase Kva ↓	Full Load Current (Amps)	Fuse Unit Rating (Amps)	Full Load Current (Amps)	Fuse Unit Rating (Amps)	Full Load Current (Amps)	Fuse Unit Rating (Amps)	Full Load Current (Amps)	Fuse Unit Rating (Amps)	Full Load Current (Amps)	Fuse Unit Rating (Amps)	Full Load Current (Amps)	Fuse Unit Rating (Amps)	Full Load Current (Amps)	Fuse Unit Rating (Amps)
1000	25.1	40E	21	30E	16.7	25E								
1500	37.7	50E	31.4	50E	25.1	40E	18.9	25E	12.5	20E	7.6	10E	6.3	10E
2000	50.3	65E	41.8	65E	33.5	50E	25	40E	16.8	25E	10	13E	8.4	13E
2500	62.8	100E	52.5	80E	42	65E	31.5	50E	21	30E	12.5	20E	10.5	15E
3750	94.3	125E	78.5	125E	63	100E	47	65E	31.5	50E	19	25E	15.7	25E
5000	126	175E	105	150E	84	125E	63	100E	42	65E	25	40E	21	30E
7500	188	250E	157	250E	126	175E	94	125E	63	100E	37.5	50E	31.4	50E
10 000	252	400*	210	300E	167	250E	126	175E	84	125E	50	65E	42	65E
15 000	376	600*	314	500*	252	400*	189	250E	125	175E	76	100E	63	100E

*Use two fuse units in parallel, each having an ampere rating half of the listed ratings.

Here's an up-to-date answer:

The answer is a qualified "yes" and depends on selection of the proper fuse in the proper ampere rating and speed.

Let's examine fuse selection. Until now, for want of a better approach, the protection engineer has had to use fusing ratios or ampere rating recommendations which were arbitrarily high. Allowances had to be made for not only short-time daily overloads *(both with, and without, forced-air cooling)*, switching, and energizing transients but also for damaging of the fusible element. Moreover, extra provision had to be blindly made for short-time emergency overloading. In this way he was assured that the fuse would not blow unnecessarily. But unfortunately, the full protective range of the modern power fuse was lost.

To help the protection engineer avoid such overfusing, S&C has developed tables of Minimum Ampere Rating Recommendations* for its SMD Power Fuse (see one of four such tables below, left), each one of which is a "sharp-pencil" recommendation that provides real protection for the transformer against secondary faults, even line-to-ground.

The key to these recommendations lies in the precise significance of the term "minimum" in contrast with the customary "cover-all" use of the word. These recommendations have been pared down by tailoring them to include provisions only for transients and short-time daily overloads of the magnitudes set forth by ASA.

These minimum ampere rating recommendations expressly *exclude* allowances for short-time emergency overload, and margins for fuse damage. Here are the reasons:

1. The margin for fuse damage is obviously unnecessary with S&C silver fusible elements.
2. The short-time emergency overloading of fuses is a nonrecurring, controllable condition — such as would occur when one transformer in a duplex substation setup is temporarily out of service (thus placing all the load on the other transformer).

To enable the protection engineer to determine what degree of short-time emergency overload an SMD fuse can sustain, S&C has developed a family of "Short-Time Emergency Overload Capability Curves." These curves plot overload time in hours against overload current. The curves will show that in most applications the fuse ratings given in the Minimum Ampere Rating Recommendation tables will have adequate short-time emergency overload capability, even though allowances were not made for such overloads in the Recommendation tables. By using this special information—new to power fuses—the protection engineer can avoid revising his ampere rating selection upwards to take care of a short-time emergency overload condition that might occur only once a year. Therefore, he does not have to give up some transformer protection.

This paring down of ampere rating recommendations is done to enable the fuse to "see" faults of a much lower order than would otherwise have been possible. A fuse naturally won't pick off the lowest line-to-ground faults, but transformer protection will be greatly increased.

Write for Data Bulletin 262, "Selecting SMD Fuse Units," to S&C ELECTRIC COMPANY, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

The ampere ratings listed in the table (left) will carry continuous loads within the nameplate rating of the transformer, or short-time daily overloads as set forth below.

Daily Overloads to Give Normal Life Expectancy

(Abstract from ASA Publication, "Guide for Loading Oil-Immersed Distribution Transformers and Power Transformers," Appendix C57.92, published January, 1956.)

Time (Hours) ↓	Times Rated Kilovolt Amperes		
	Self-Cooled and Water-Cooled Transformers		
Initial Load* (Percent) →	90	70	50
½	1.59	1.77	1.89
1	1.40	1.54	1.60
2	1.24	1.33	1.37
4	1.12	1.17	1.19
8	1.06	1.08	1.08

*Use either average load for two hours previous to load above rating or average load for 24 hours (less overload period), whichever is greater. Ambient temperature assumed is 30° C for air and 25° C for water.

S&C ELECTRIC COMPANY

Field experience proves performance advantages of Preformed splices

In hundreds of thousands of applications, only one failure of a Preformed splice has been reported—and that was caused by inadequate preparation of a heavily corroded conductor.

This distinctive performance is the result of soundly engineered features: (1) uniform radial pressure of the splice rods; (2) full area of contact; (3) the flexibility of the rods which causes the grit particles to penetrate existing oxides and establish permanent electrical contact with the conductor; and (4) the inherent resiliency of the splice which maintains consistent surface contact with the conductor throughout extremes of line tension and temperature variation. These combined characteristics are your assurance of unfaltering mechanical and electrical performance at all times.

And, most important, no tools are needed to install a Preformed splice; the application is made entirely by hand and takes but a fraction of the time required for other types of splices.

There are Preformed splices to solve almost every splicing problem. They can be furnished to hold the full-rated strength of any standard transmission or distribution conductor.

Write for additional technical information. PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland . . . manufacturer of armor rods, dead-ends, Guy-Grip dead-ends and other line accessories.

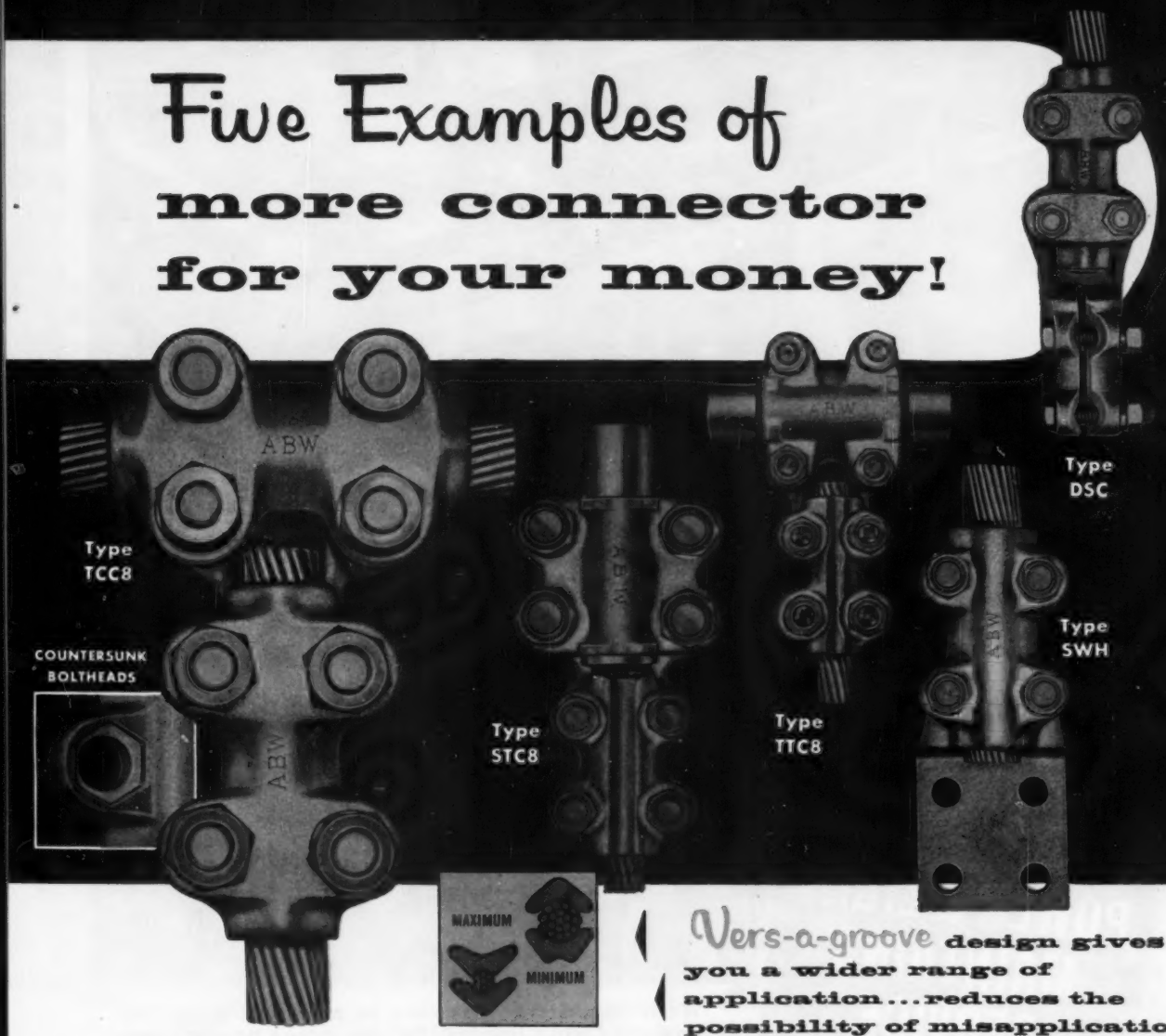
PLP

10 YEARS OF Preformed Line Products

You can look up to **Preformed**

Made in accordance with or for use under U.S. Patent Nos. 2,609,653; 2,275,019; 2,587,521; and 2,691,685. Other patents pending.

Five Examples of more connector for your money!



Vers-a-groove design gives you a wider range of application... reduces the possibility of misapplication!

The 9 *stand-out features* of these Anderson Substation Connectors cannot be duplicated by any other connector line available. Look over these features carefully... *several manufacturers may claim some of them, but no connector line has them all!*

1. Two complete pairs of clamping bolts on both main and tap provide *extra insurance* against connector failure. *Most other designs have only six bolts.*
2. Higher clamping pressures with greater contact lengths *than in other standard connectors.*
3. Completely independent (3-piece) clamping on main and tap. Connection can be removed on one side without disturbing contacts on the other. *Most other connectors are two-piece.*
4. Conductor range practically eliminates mis-application and resulting connector "burn-downs". *Limited or no range of other connectors invite mis-application trouble.*
5. Wider conductor ranges permit considerable reduction in overall number of connectors which must be carried in inventory. *Two and three times greater inventory is required with other connectors.*
6. More connector for the money! More metal... 8 bolts instead of the ordinary 6 bolts!
7. One of the greatest advantages of these Anderson Vers-a-groove Tee Connectors is *ease of installation.* The 3-piece design, with independent clamping on main and tap, means that tap conductors may be bolted in on the ground and passed up to install over the bus runs. *Ordinary 6-bolt, 2-piece connectors much more cumbersome and difficult to handle.*
8. Cast surfaces which are inherently rough and tough mean positive electrical contacts. This feature plus the greater clamping strength of these connectors is a *distinct advantage in overall efficiency.*
9. The design of these connectors, by Anderson, has proved itself over more than 27 years of service under all conditions in all parts of the country. *Once used... tried and proved... no customer has ever switched back to an ordinary connector.*

For more complete information, including engineering and design data, performance characteristics and other particulars, consult your nearest Anderson Representative, or write to our home office.

ANDERSON ELECTRIC CORPORATION • Birmingham 1, Alabama

ANDERSON ELECTRIC

Research / Quality / Performance / in Aluminum and Bronze Products

Aluminum and Bronze Power Connectors • Clamps • Fittings • Accessories for SUBSTATION • TRANSMISSION • DISTRIBUTION

Shown here, inspecting Kansas City Power & Light's new Mobile units are, left to right: I. C. McLain, RT&E representative; R. L. Wright, E. D. Church and F. D. Cochran of Kansas City Power & Light.

KANSAS CITY POWER & LIGHT MAINTAINS SERVICE WITH RT&E EQUIPPED MOBILE UNITS

When necessary repairs must be made to Kansas City Power & Light's line installations, there's no shut-down on power to customers. Mobile substations like these are wheeled into action, taking over the transformer job while replacement or repairs are made on line units. Service is maintained without interruption.

The heart of these mobile substations depends on versatile RT&E DUAL VOLTAGE TRANSFORMERS . . . rated at 100KVA, 2400x7620 — 120/240/277 volts with *Externally Operated Taps* at 8000/7810/7430/7200 volts. These special units also incorporate RT&E's *Externally Operated primary voltage change-over switch.*

This is just another example of RT&E transformers at work, proving again their merits with many of the industry's outstanding and exclusive features.

EXCLUSIVE WOUND CORE
"WEATHER PROTECTED" DESIGN
EXTERNALLY OPERATED CHANGE-OVER SWITCH
EXTERNALLY OPERATED TAPS
FIVE YEAR GUARANTEE

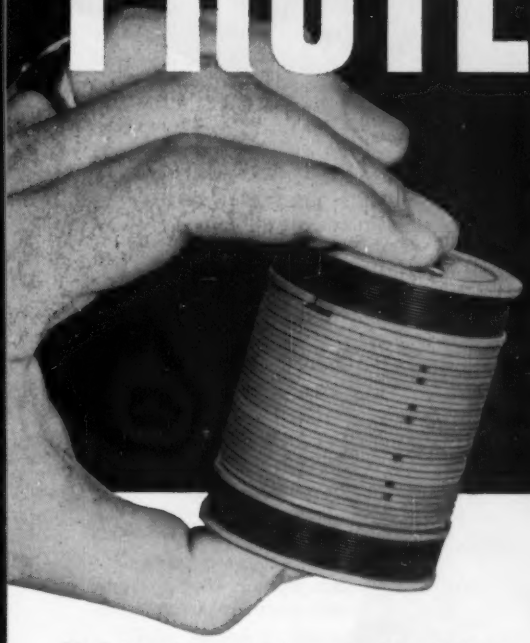
Ask your RT&E representative to demonstrate the five sound reasons why RT&E transformers are better. Or write RT&E Corporation, Waukesha, Wisconsin.

RT&E CORPORATION WAUKESHA, WISCONSIN

HELPING PROVIDE POWER FOR AMERICA

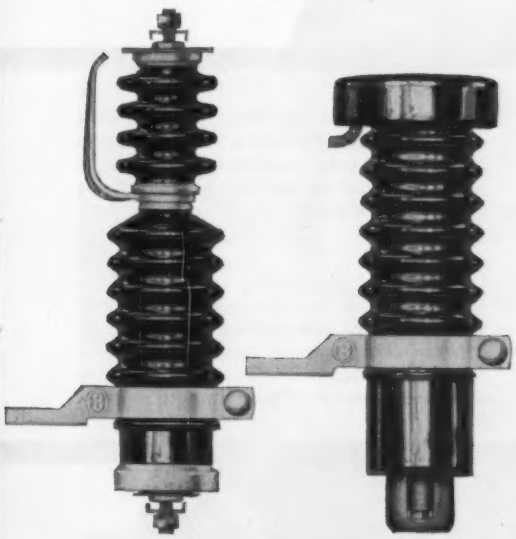
BIGGER PROTECTION

Average Price ★ Smallest Size



Thorex Dynagap Distribution Arresters put Station Quality Protective Equipment on Your Poletops...at no Premium...Conveniently

Used interchangeably in every class of Thorex lightning arrester -- all the way to 350 kv -- the remarkably compact Dynagap element imparts many basic factors of station class protection to your distribution circuits.



Heart of all new Thorex lightning arresters -- the Dynagap element -- is interchangeable in all classes; station, intermediate, and distribution. This puts station quality protective equipment on your poletops. Durability has reached an entirely new order. The arrester can be located, or later re-located anywhere, regardless of load or feeder capacity. With these features that make it big in service protection, the new Thorex Dynagap distribution arrester is physically smaller than any comparable device.

You can install these new arresters on your own pole locations, or specify them as part of any new transformer you order. In either case, they carry no price premium over other valve types.

Change to the new and radically improved Thorex Dynagap and up-grade your distribution arrester protection.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

4902-H

Main work-aisle at the East Pittsburgh plant shows the extensive area available for building breakers to meet the demands of rapid system expansion in progress today. At rear is high-voltage test equipment to hi-pot complete breakers and components.

Tank interior reveals the ready accessibility of interrupter grids for inspection or maintenance. Without removing grids from bushing, interrupter blocks can be removed to reveal stationary fingers and moving contacts. Contacts can be replaced in tubes without loss of interrupter alignment.

HIGHER INTERRUPTING CAPACITIES THROUGH WESTINGHOUSE CIRCUIT BREAKER DEVELOPMENT

The outstanding protection provided by today's power circuit breakers is a primary factor in the growing load-carrying ability of modern electric utility systems. Their increased interrupting capacities, higher voltage ratings, faster operating time and improved electrical design all permit increased system capacities, greater system integration.

Every major advance in the art of circuit interruption during the past 50 years has originated at Westinghouse . . . result of a policy of reinvesting earnings into research and development. Here are a few important breaker design contributions:

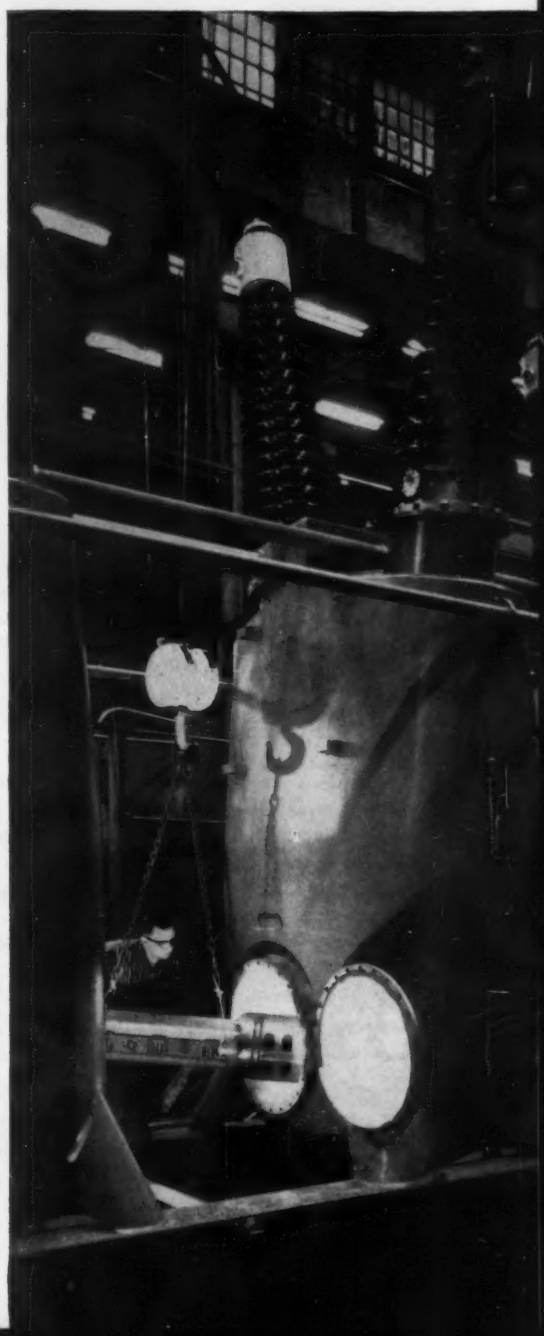
DE-ION® TUBULAR GRIDS — providing the highest interrupting capacities and most reliable operation in all voltage ranges. In addition, these grids allow the easiest interrupter inspection and maintenance possible today.

WATCH-CASE® TANKS — permitting higher voltage and interrupting ratings without a proportional increase in space. Oil requirements reduced as much as one-half with corresponding cut in maintenance costs.

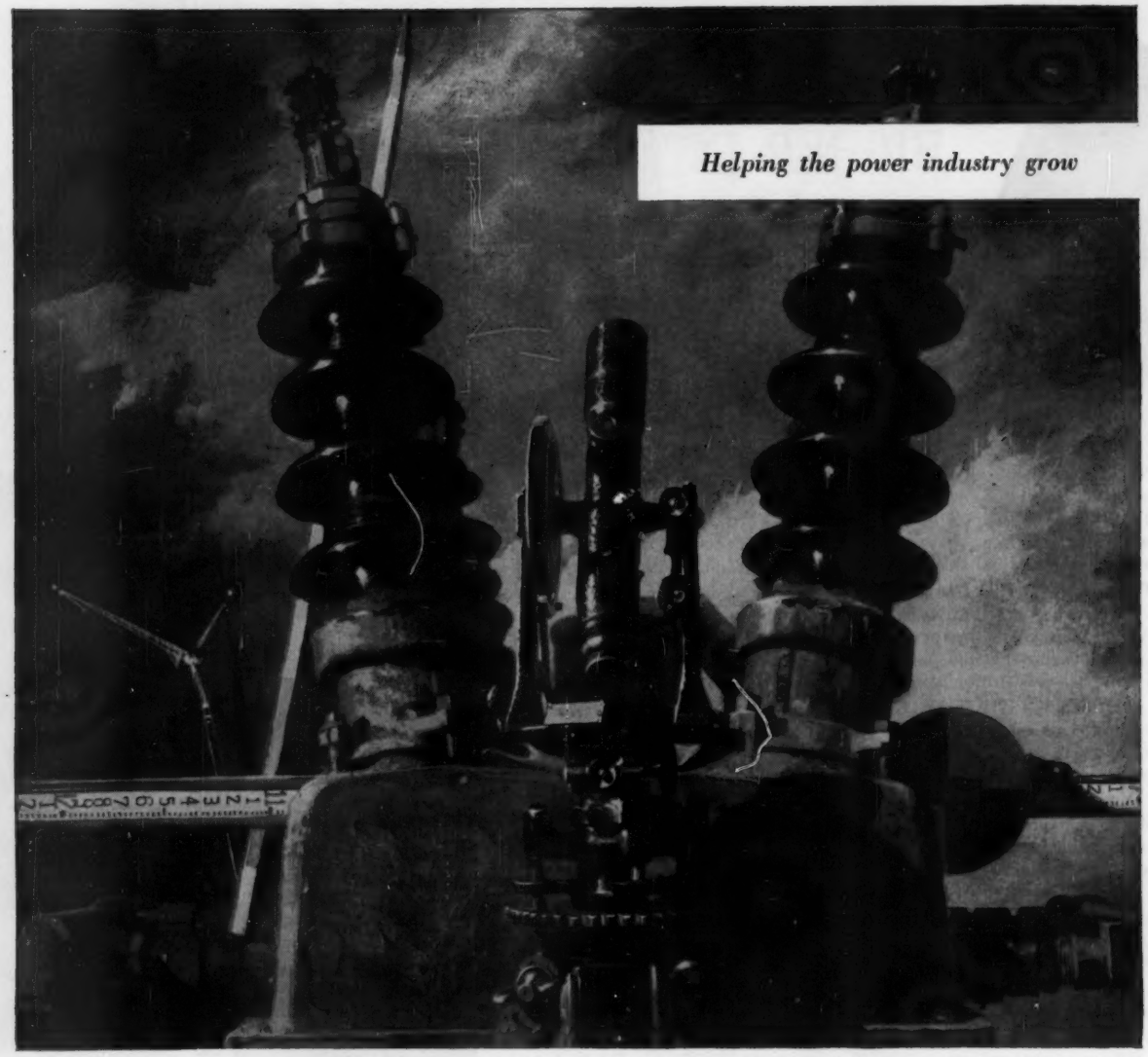
CONDENSER BUSHINGS — developed over 50 years ago by Westinghouse and recently adopted by the entire industry, have proved to be the most reliable and trouble-free bushings ever designed.

Developments such as these are part of a continuing program of research and development which keeps Westinghouse ahead of your system requirements.

When planning expansion of your system capacity, call your Westinghouse sales engineer to learn how you can reduce total system investment, operating and maintenance costs. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60955



YOU CAN BE SURE...IF IT'S Westinghouse



High-voltage ceramic insulators capable of holding tremendous electric power under control; transit and leveling rod; the slender arms of a swinging boom—these are combined by Stanley Meltzoff to tell the story of the growth and expansion so typical of America's responsible, progressive electric power industry.

Constructing in Five Dimensions

Many projects must be executed not only in the conventional three dimensions, but also within the inflexible limits of time and budget. Our skilled and experienced team has proved many times its ability to complete a project on schedule and at a cost both reasonable and controlled. The range of our services is broad and flexible; facilities can be adapted precisely to moderate or extensive needs.

We have served many of the country's leading utilities and industrial firms on such projects as thermal and hydroelectric plants, electric substations, and installations for supplying heating and process steam.

Our many new assignments from clients previously served speak for the caliber of our past performance. Our more than 70 years' experience assures you of maximum return on each dollar expended.

We invite you to share and profit from this background.

UNITED ENGINEERS

& Constructors Inc

U.E.&C. (Canada) Ltd.

Designers • Constructors • Consulting Engineers

New York • PHILADELPHIA • Chicago

FREE!

THE ONLY PRACTICAL ON-THE-JOB TAPE CUTTER* IN THE INDUSTRY

- GET A QUICK, CLEAN CUT
- STOP WASTING TAPE
- END FUMBLING FOR NEXT CUT

FREE with every 66' roll of

SLIPKNOT NO. 7 PLASTIC TAPE

*pat. pending

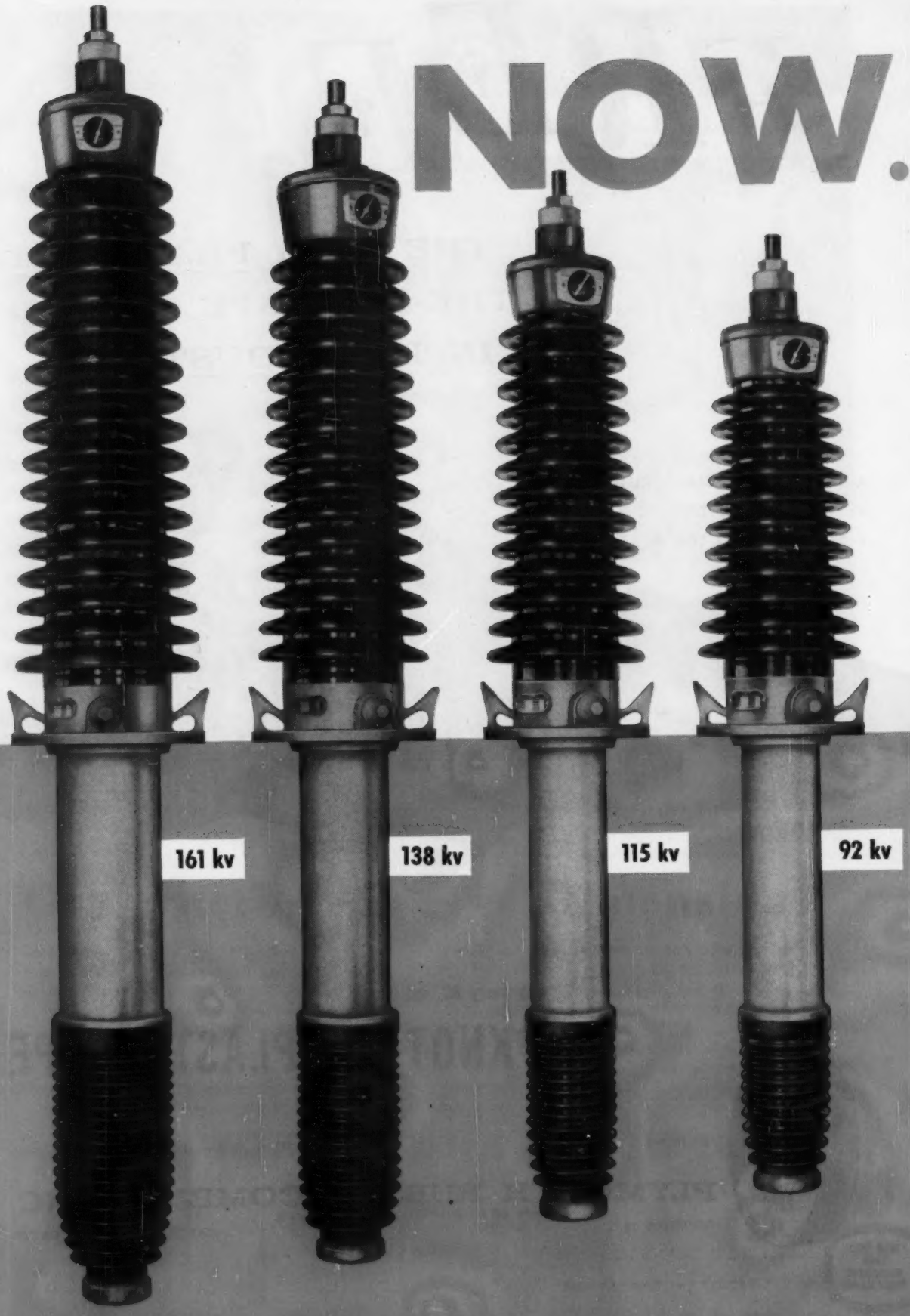
Write for free sample on your letterhead

PLYMOUTH RUBBER COMPANY, INC.

Makers of SLIPKNOT FRICTION TAPE

DIVISION 19 — CANTON, MASSACHUSETTS

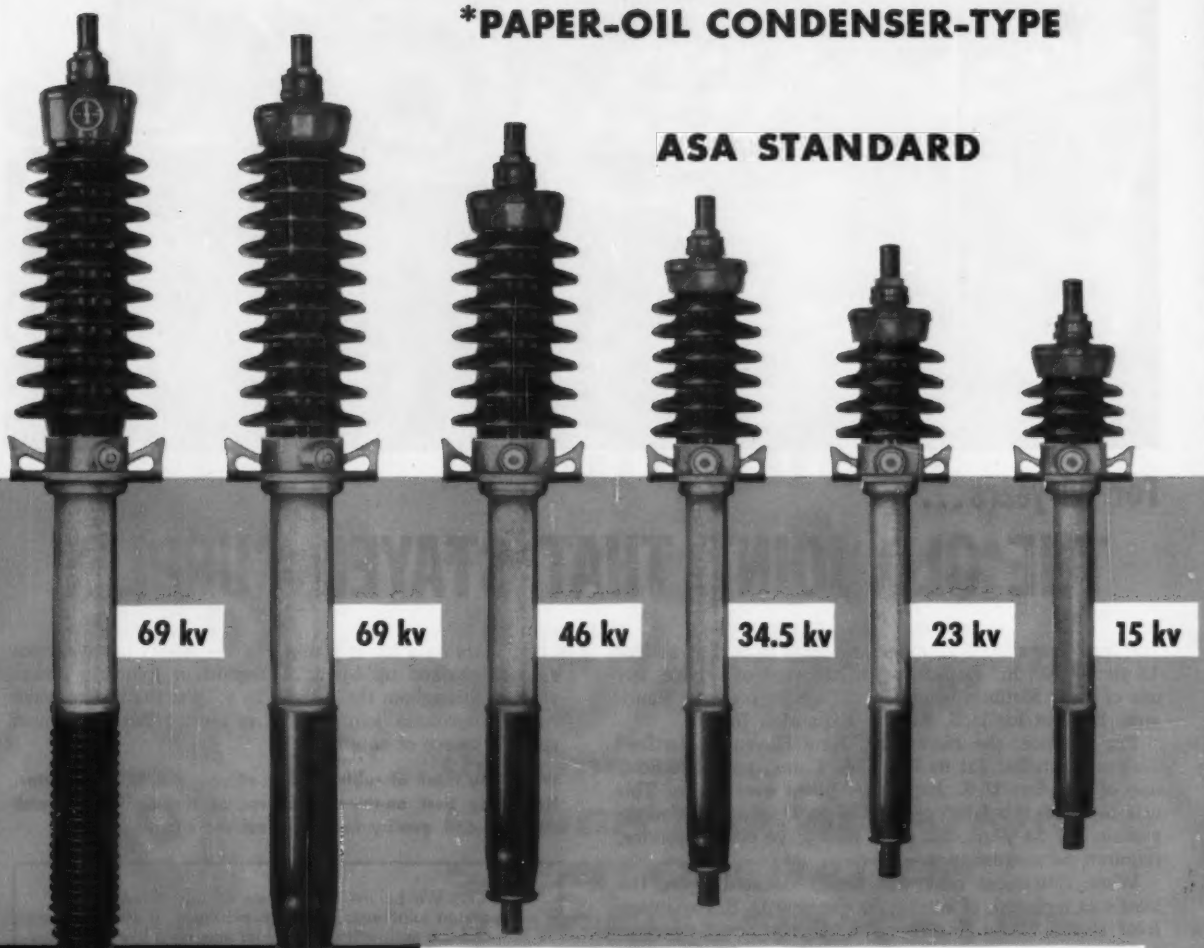
NOW.



Lapp POC* Bushings
in voltage ratings to 161 kv

*PAPER-OIL CONDENSER-TYPE

ASA STANDARD

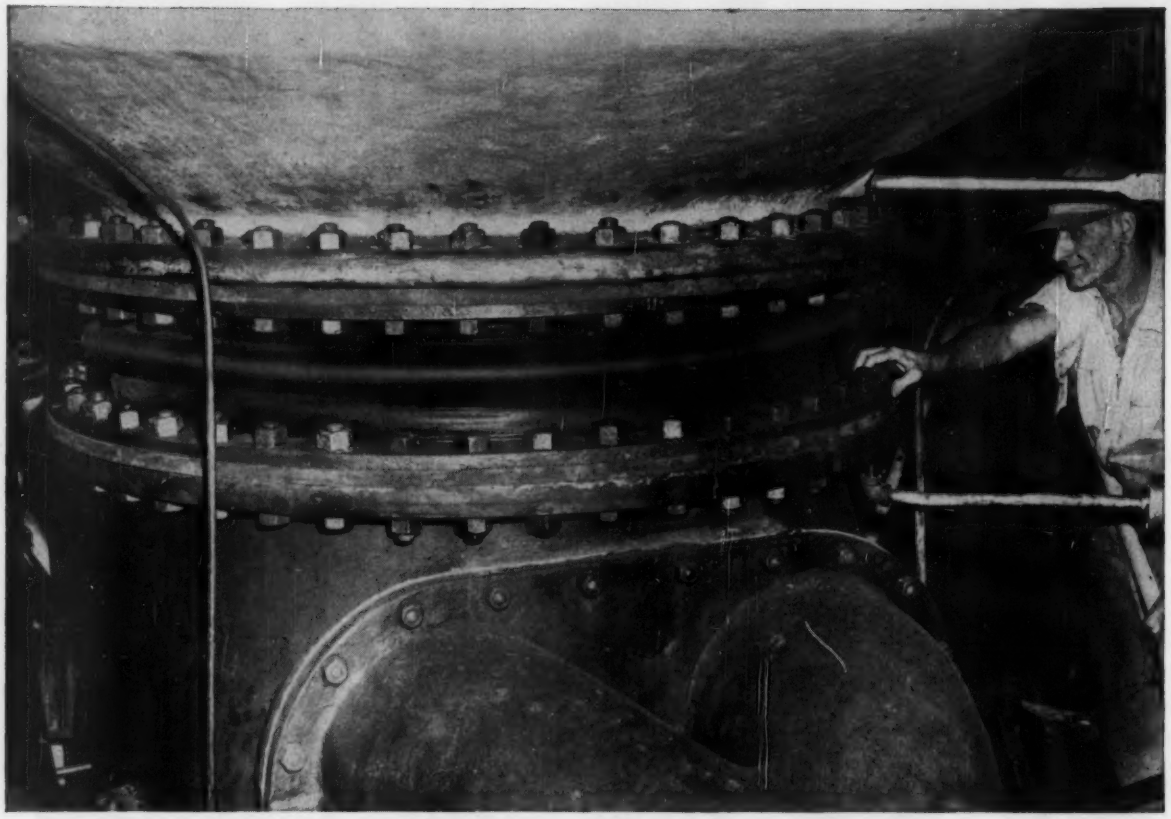


Lapp

At every voltage rating from 15 kv up, Lapp POC* Bushings provide the operating security of totally-enclosed design...
...all exposed insulation is *porcelain.*

Lapp Insulator Co., Inc., Le Roy, N. Y.

US RUBBER EXPANSION JOINTS



For 34 years...

THE OLD JOINT THAT STAYED SUPPLE!

Just how long should a rubber expansion joint keep active? 15 years? 20? 25? Depending on the type of service, any one of these lifetimes would be old age by ordinary standards. But not for U. S. Rubber Expansion Joints.

For instance, the New York, New Haven & Hartford Railroad installed (at its Cos Cob, Conn., power station) one of the first U. S. Expansion Joints ever made. This was in 1924, the first year of Calvin Coolidge's administration. For 34 years, the U. S. Joint gave perfect service, required no maintenance.

When retirement time was finally decided upon, the joint was replaced, of course, by the new U. S. Expansion Joint shown above. Incorporating all the latest developments, this new joint is expected to give a performance worthy of its predecessor.

34 years on a job is just one of the many, many service records chalked up by U. S. Expansion Joints in power stations throughout the world. "U. S." was the first to make rubber expansion joints, and has always been the most reliable source of supply.

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

NOTE: We believe this is one of the oldest rubber expansion joint installations in existence. If you know of, and can authenticate, an older one, we'd like to hear about it, and we'll send you a $100 U. S. Savings Bond.

US RUBBER

Mechanical Goods Division

United States Rubber

Rockefeller Center, New York 20, N.Y.

In Canada: Dominion Rubber Company, Ltd.

These smaller-lighter
WAGNER FORM W TRANSFORMERS
offer

MECHANICAL and ELECTRICAL ADVANTAGES

that mean

EASIER INSTALLATION
SAFER OPERATION
LONGER SERVICE LIFE

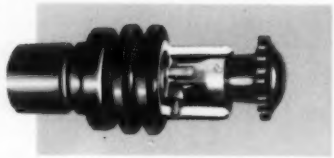
MECHANICAL FEATURES

that give you easier installation... safer operation

WAGNER DISTRIBUTION

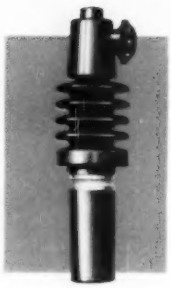
HIGH VOLTAGE SIDEWALL BUSHING

Connections can be made faster—more safely because chuck type terminal eliminates need for tools and insulated hand knob protects lineman when tightening the terminal. Takes either copper or aluminum conductor.

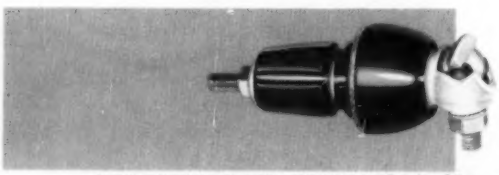


HIGH VOLTAGE COVER BUSHING

Bushing has phenolic insulating cover for bird and squirrel protection. Connections are quickly and easily made with the clamp type terminal and insulated hand knob. Plated clamping surfaces permit use of copper or aluminum conductor.



SHUR-SEAL CLAMPING RING—Holds cover to the tank with an airtight seal . . . no atmospheric moisture or dust particles can get inside to contaminate the oil and shorten transformer life. No oil can leak out during shipping or handling. Cover may be removed by loosening a single bolt.



LOCKED LOW VOLTAGE BUSHING—The bushing and terminal are double locked to prevent slipping or turning when terminals are tightened. Eliminates loose inner terminal connections that could cause short circuits. Can be used with aluminum or copper conductor.

WINDING TEMPERATURE OVERLOAD INDICATOR*

Flashes a red warning light to give advance indication that overloads are nearing the danger point. Helps you prevent service interruptions. Indicator is actuated by winding temperature—eliminates time delay of oil temperature actuation.

*Can be furnished on transformers from 3 to 100 kva.

Wagner has 67 years of experience in transformer engineering and manufacturing. In the Form W design, Wagner offers the electric utility industry a complete line of transformers for modern distribution systems.

Form W Transformers are designed and built to NEMA standards, are given all prescribed commercial tests, and production line impulse tests to meet Wagner's standards for uniformly high quality. They are small in size—light in weight . . . easy to handle, to store, to mount on poles.

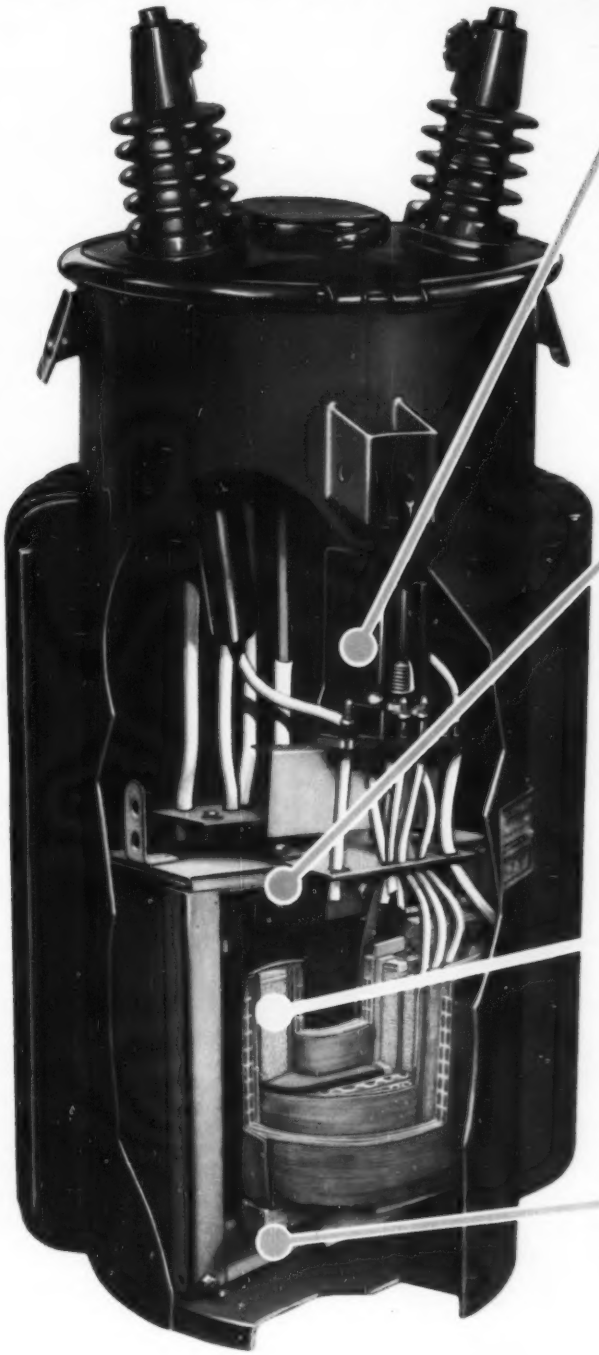
The Form W line includes a complete range of single-phase ratings, 500 kva and smaller, 69 KV and below, in conventional or protected types. All ratings from 3 to 167 kva, 15 KV and below, are designed for pole mounting.

Call the Wagner Sales Engineer in your area for complete information about Form W Transformers, or write for your file copy of Wagner Bulletin TU-141.

Wagner Distribution Transformers

FORM W TRANSFORMERS

ELECTRICAL FEATURES
that add up to long, troublefree service life



ROTARY TAP CHANGER

Easily accessible through cover hand hole. Handle and index plate are above oil level in the tank. Gives positive action because a pre-loaded spring in the handle (note cutaway) keeps constant pressure between the contacts and the tap studs.

FORM W CONSTRUCTION

CORES of cold rolled oriented grain transformer steel are specially annealed for the lowest possible magnetic losses. Cores are cut into two turn sections and are assembled through and around the coils, without need of banding.

COILS are wound of carefully selected pure copper wire or strip. Insulation of high dielectric strength is used between layers in the high and low voltage windings. This insulation has crimped edges which hold the windings firmly in place for permanent electrical clearances.

BONDED INSULATION

Layer, channel and barrier insulation is coated with a thermo-setting material that bonds the coil structure into a unit with great mechanical and electrical strength.

ENDPLATE STRUCTURE

The Form W element is clamped in an endplate structure that is light but strong. This structure holds all parts securely in position and provides a firm mounting for the tap changer and lead supports.

the choice of leaders in the electric utility industry

Wagner Pole-Type

FORM W TRANSFORMERS

...available from stock in all standard ratings to meet your distribution system requirements

TYPE HEB—5000 Volts and Below. Typical Construction — 3 through 15 KVA.

TYPE HEK—5001 to 15,000 Volts. Typical Construction — 25 through 50 KVA.

TYPE HEB—5000 Volts and Below. Typical Construction — 25 through 50 KVA.

TYPE HEK—5001 to 15,000 Volts. Typical Construction — 75 and 100 KVA.

TYPE HEB—5000 Volts and Below. Typical Construction — 75 and 100 KVA.

TYPE HEK—5001 to 15,000 Volts. Typical Construction — 167 KVA.

LIVE BETTER ELECTRICALLY

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

WT58-11

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6400 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

New Dodge Tradesman—a pick-up with side lockers.

Here's what a leading automotive magazine reports about fuel economy— in the 3 low-priced trucks

The best way to compare products is to *test* them thoroughly. That's exactly what a leading automotive magazine's test drivers did with *all three* low-priced pick-up trucks. The results are revealed in a recent issue. One important result was that the Dodge V-8, even with its extra power, gave better gas mileage than the other two V-8's tested.

Here are some of the statements reported in this magazine about the Dodge *Power Giant* pick-up:

First in economy! The magazine reports on overall gas mileage, "In spite of the lowest gear, 4.11, and the largest displacement engine, the Dodge proved to be the most miserly, averaging 13.5 mpg."

First in payload! The article says, "All test drivers agreed that the Dodge was the best equipped of the three when it came to carrying a good load."

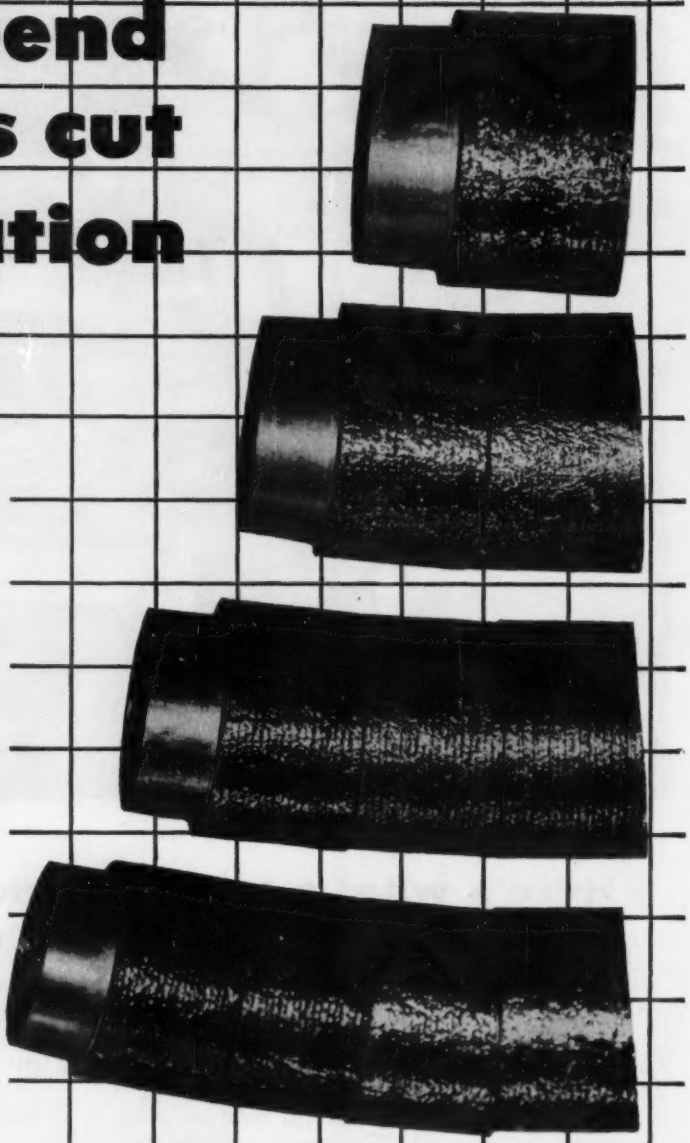
First in power! The magazine states, ". . . the Dodge had quite a hill climbing advantage over the other trucks."

First in styling! No mention of styling was made in the magazine's report, since it was a *performance* test. We'll leave that comparison to you—confident that you'll rate Dodge number one.

Make your own test of the four-way leader of the low-priced three, at your Dodge dealer's. Do it soon, and get his special 40th-Anniversary deal!

4-way leaders of the low-priced 3 **DODGE *Power Giants***

These bend sections cut installation costs



Orangeburg 5° Bend Sections are the "on-the-job" answer to special bend problems. They get over, under or around those unforeseen obstructions . . . and do it easily and economically.

Crossovers . . . transformations . . . offsets . . . can be made in the field by joining sections together to obtain the desired direction change. No costly delays . . . no special bends needed.

Orangeburg 5° Bend Sections* are another reason why Orangeburg Fibre Conduit is the ideal protective raceway for underground electrical cables.

Distributed by Graybar Electric Company and General Electric Supply Company. Branches and stocks in principal cities.

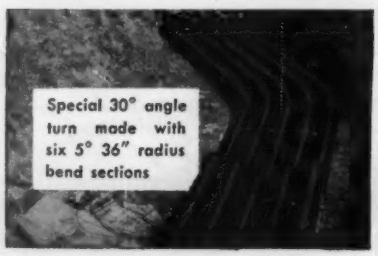
Write Dept. EW-58 for Bulletin S.E.C.

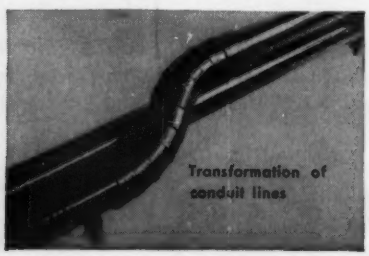
**Made for Orangeburg Standard Conduit only.*

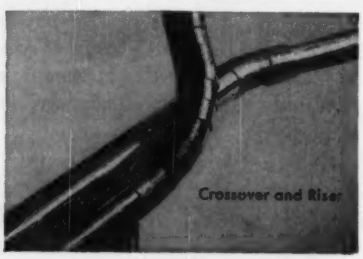
ORANGEBURG MANUFACTURING CO., INC.
Orangeburg, N. Y. Newark, Calif.

ORANGEBURG®

FIBRE CONDUIT PROLONGS CABLE LIFE







HIGHWAY SKID-MOUNTED

EARTH-BORING MACHINES

. . . dig the hole . . . . set the pole . . . .

Spotter-Base for hydraulic positioning in an 80" arc, in-and-out motion of 22".

Available on full Swing-Base for curb-side digging or Spotter-Base for easy positioning. Write to Highway for complete information.

10 plus features

1. Designed and built rugged and sturdy for tough daily use.
2. Powerfully made to dig holes up to 36" in diameter and 10 feet deep in any soil conditions.
3. Can be quickly mounted on any type or make of truck having sufficient capacity to carry its weight.
4. Can be equipped with integral winch and derrick with a rated capacity of 4500 pounds.
5. Can be quickly adjusted to dig at many angles regardless of position of truck.
6. Auger bar and pole derrick are raised from traveling to working position by power.
7. A complete earth-boring machine, integrally assembled with engine, clutch and transmission.
8. A new adjustable clutch with side ports in the clutch case affording easy access for adjustment.
9. New winch takes power directly from transmission. Utilizes all speeds of transmission.
10. Optional hydraulic controls for easier, faster operation.

HIGHWAY®

UTILITY DIVISION

HIGHWAY TRAILER COMPANY

HEADQUARTERS: EDGERTON, WISCONSIN

Manufacturers of: Public Utility Bodies • Earth-Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-offs • Service Accessories • Commercial Trailers • Trailerized Tanks and Dry Bulk Haulers

SALES AND SERVICE IN PRINCIPAL CITIES

EACH LINE MATERIAL TRANSFORMER is issued an IBM card upon which are placed all test results and reference information pertinent to the unit. Cards are microfilmed as a permanent record.

How L-M's Quality-Control System Insures High Transformer Standards

By **ROBERT P. THOMPSON**
Manager of Engineering
Transformers
Line Material Industries

Performance characteristics of L-M Round-Wound® transformers are outstanding. Physical features are exceptional. Quality is *built in* to L-M transformers, not tested in. To make doubly sure of maintaining uniformly high quality, L-M has established a very tight quality-control system.

Continuous tests are made—from raw materials to finished product. A final assurance of quality is the permanent microfilmed record of test information kept on every L-M transformer.

CORE TESTING: The tolerance permitted in testing the bare core of L-M's Round-Wound transformer is much more stringent than required by NEMA and ASA of core performance in the completed transformer.

The specially trained craftsmen who make Round-Wound transformers take pride in the high quality of their work—no small contribution to the continued excellence of Round-Wound transformers and their amazingly low failure rate—less than 2/10 of 1 percent!

Check on Incoming Materials

All raw materials and parts for L-M Round-Wound transformers are rigidly and systematically inspected. For example:

- Every high-voltage porcelain bushing is subjected to acceptance dielectric tests.
- Samples of all wire are tested for resistance and cross-section uniformity; coating is tested for dielectric strength, adherence, thickness.
- The cold-rolled oriented silicon steel used in making L-M's wound core is tested for physical and magnetic characteristics by means of a precision Epstein tester. Rigid standards on the loss and permeability characteristics are maintained.

In-Process Tests

A continuous "in-process" testing and inspection program is followed throughout the plant. Cores are tested for magnetic characteristics before and after copper coils are wound upon them. Coils are checked for ratio and given a mechanical inspection immediately after being wound. All finished units are thoroughly tested for leaks.

COIL RATIO TEST: Ratio and polarity are checked immediately after the coil is wound, so as to maintain close surveillance of the coil-winding operation at all times.

When the unit is completed, every transformer is given a complete series of electrical tests in strict conformity with NEMA and ASA standards. These tests include core loss and excitation current, copper loss and impedance, ratio, induced voltage, high potential, polarity, and impulse.

Certificate of Test

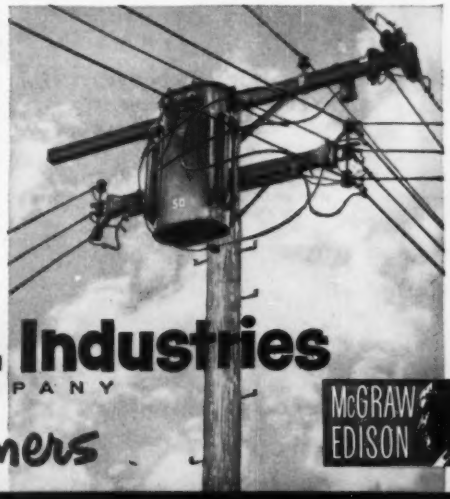
Each transformer is issued an IBM card which follows the unit through to completion. The card provides space for all test results. It is punched or filled in at each inspection and test station if, *and only if*, the transformer satisfactorily meets all the requirements of NEMA standards and of the L-M engineering and quality-control departments.

When the transformer is shipped, the cards are microfilmed and then stored to provide actual test data throughout the life of the transformer. This complete test information can be furnished to you at any time on any transformer.

Compare L-M's high standards of performance and outstanding physical features with other transformers; you will see why more customers are specifying L-M Round-Wound transformers.

Get Complete Information

Ask your L-M Field Engineer for complete information on the outstanding performance characteristics of L-M Round-Wound transformers and on L-M's unique obround tank. Or write Line Material Industries, Milwaukee 1, Wisconsin.

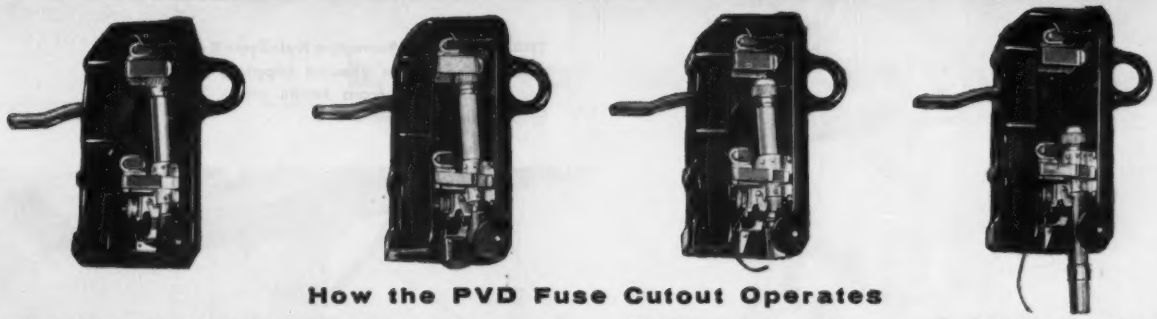


LINE MATERIAL Industries
McGRAW-EDISON COMPANY
Transformers

McGRAW EDISON

DOOR IS EASY TO OPEN. Handle is high up on the door to assure good leverage, and hole is large enough to insert hookstick easily, yet small enough so hook will not slide down or jump out. Available in standard-duty ratings and new heavy-duty interrupting ratings of 5000 amps. at 5.2 kv and 8000 amps. at 2.6 kv.

THE DOOR IS REMOVED, unhooked, and replaced, all with the hookstick. A special hook on the door assembly makes this convenient.



How the PVD Fuse Cutout Operates

1. Fused position. Door always closed—operation is independent of door. As the link blows, spring-loaded lever flips out the fuse link leader—fast!

2. This instantly separates blown link parts, clearing the arc inside the tube. It also releases a latch which permits the bright yellow fuse tube to drop out.

3. Upper spring contact pushes the tube down and follows it part way, giving extra time to clear the arc, and eliminating burning of contacts. Action is positive.

4. Cartridge drops to indicating position easily seen from the ground. Large air gap prevents re-establishing the arc. No leakage, no radio interference.

How L-M's Famous PVD® Cutouts Provide Faster, Safer Operation

Positive dropout operation provides indication easily seen from the ground. For re-fusing, door is easily removed and replaced with hookstick; high-pressure silver contacts insure long life. Now also available in heavy-duty designs.

By **GEORGE W. COOPER**
Product Manager
Protective and Power
Switching Equipment
Line Material Industries

When a fuse blows in L-M enclosed dropout cutouts, a latching lever flips out the fuse and permits the cartridge to drop to indicating position. Upper contact spring follows tube part way, giving extra time to clear arc inside the tube. Contact spring also provides a downward thrust on the tube to assure positive dropout operation.

The large air gap which results between the tube and the upper contacts on the box prevents re-establishing of the arc. This assures long service, eliminates leakage and possible radio interference. Door remains closed following fuse operation; parts are always protected.

Positive Low-Resistance Contact

L-M's silver-plated spring contacts and round blade provide a very high-pressure, multi-point contact surface. In addition to the side contact clips, the spring-top clip provides additional contact and current path.

L-M's heavy contact construction provides ample metal to conduct heat away rapidly from the multi-point contact surface. This results in cool operation, and resistance is kept low.

Blown Fuses Easily Located

When the cartridge in L-M's enclosed cutout is in indicating position, it is easily seen from the ground—from any angle. The lineman locates the blown fuse quickly; thus he saves operating time and restores service faster.

Easy To Re-Fuse With Hookstick

The pull ring handle on L-M's PVD cutouts is high up on the door to assure good leverage when operating the door. This, plus a hook on the flipper assembly, make it easy to open and unhook the door, and to replace it with a spare fused door, the whole job being done with the hookstick . . . in just a few seconds.

In the open position, all parts of the door and cartridge assembly are electrically dead.

When the door is closed, the two hinges and the lower contact hold the door and cartridge assembly firmly. This, plus the guiding action of the top contact, assures that the door will close properly every time.

L-M Family of Dropout Indicating Cutouts

Interrupting Capacity Amp.	5.2/2.6 kv		7.8 kv	
	50 Amp.	100 Amp.	50 Amp.	100 Amp.
2000/3000	PVD			
3000/5000		PVD		
5000/8000	PHV*	PIV*		
2000			PVD	
3000				PVD

**New heavy-duty ratings*

In addition to the dropout indicating cutouts above, L-M offers a complete line of non-dropout indicating and non-dropout fuse cutouts.

Ask your L-M Field Engineer for more complete information, or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ont.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY
fuse cutouts and fuse links

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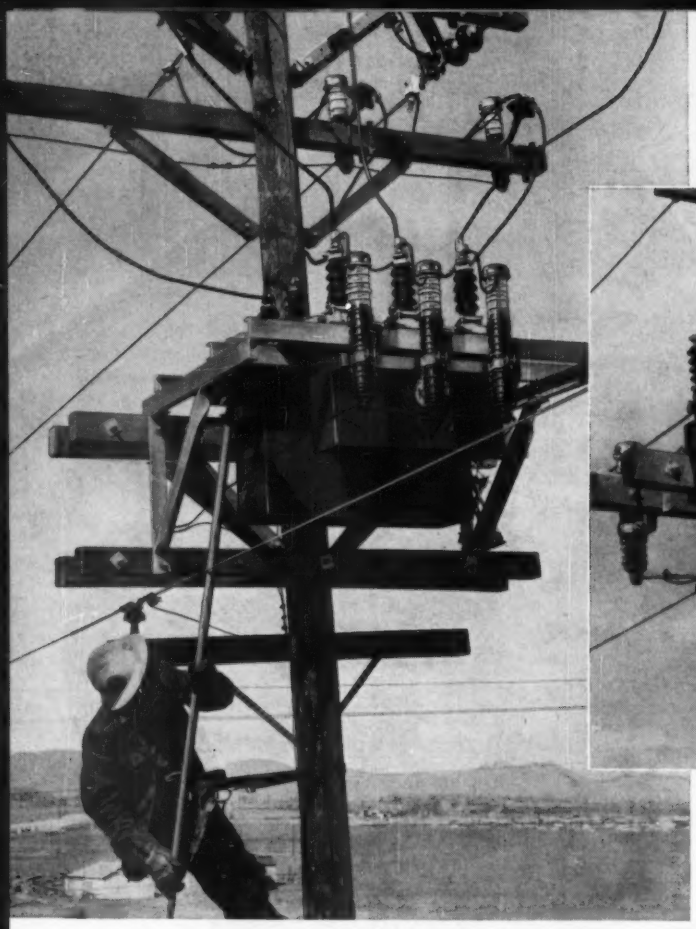
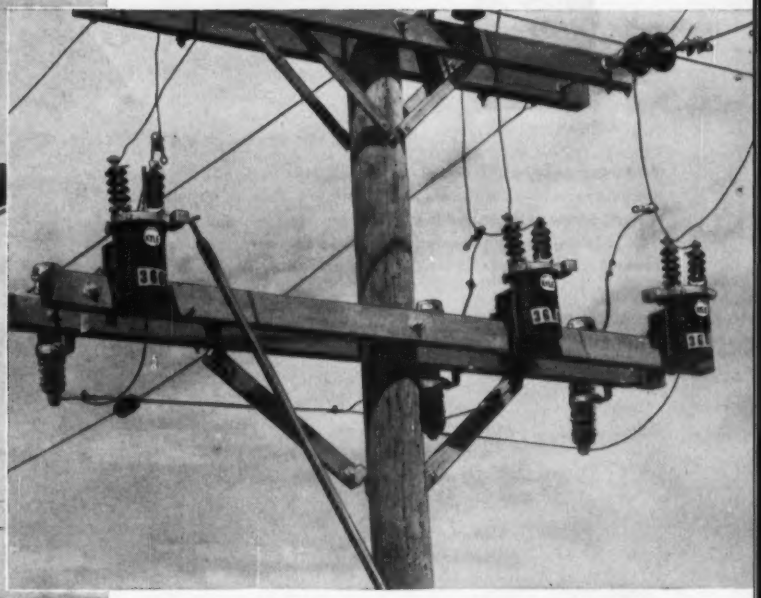
McGRAW EDISON



THREE-PHASE 185-ampere KyleType R recloser with 200-ampere ground tripping protects the main circuit from faults on a 3-phase branch line in Denver.



THREE 140-AMPERE single-phase Kyle sectionalizers protect the main feeder from faults on short branch lines, and also sectionalize areas behind reclosers. These are operated either by recloser or station breaker.

Report From Public Service Company of Colorado...

Standard Recloser Application Program Conserves Time For Utility's Engineers

Fundamental plan simplifies application of reclosers and sectionalizers; conserves engineering, record-keeping, and storekeeping time; gives better conductor protection.

A standard application plan for reclosers and sectionalizers offers many advantages. With a predetermined program, this equipment is selected and installed according to the plan, without any further engineering.

Basically the plan consists of selecting certain ratings of reclosers and sectionalizers to be applied to branches according to load, line length, and exposure. The plan automatically assures adequate protection against burndowns, gives better assurance of service continuity, and insures coordination.

Public Service Company of Colorado is an outstanding example of a utility with a fundamental protection plan. According to Messrs. Hayden, Martin, and Tilson, electrical engineers for P.S. Company, in the first year "savings in engineering time, record-keeping, and storekeeping have been so obvious as to warrant considerable enthusiasm. Also field experience so far has been most gratifying, because it has indicated that definite and concrete operating benefits have been and will continue to be enjoyed as a result of this plan."

This and other programs provide for complete flexibility. In the original program, any ratings and sequences that engineering prefers are selected. Thereafter the plan is applied automatically. The plan provides for switching or dividing load areas or feeders, and for taking care of increasing loads.

Ask Us For Details

Bulletins on Kyle Reclosers and a copy of a paper on the Colorado plan are available. We'll be glad to supply you with copies. Ask the L-M Field Engineer, or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

McGRAW EDISON

LINE MATERIAL Industries Kyle® Reclosers

McGRAW-EDISON COMPANY

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'Let's Make History Instead of Simply Recording It . . .'

There's been a lot of recession talk lately, and it is a refreshing, healthy sign when a prominent executive of a leading utility, chooses to ignore it in a major address, and concentrate on one of the long-range, history—making aspects of our business.

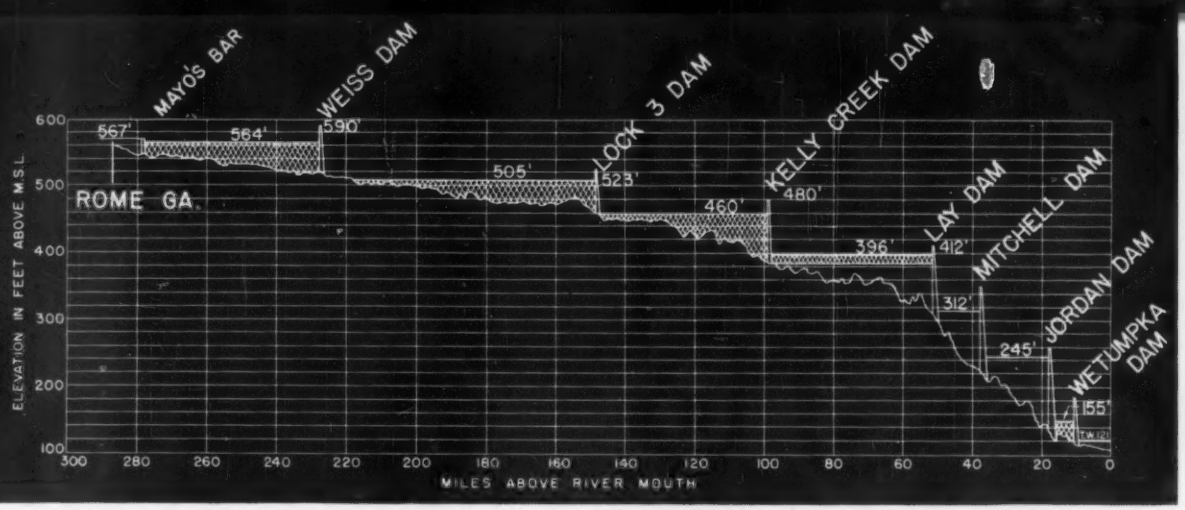
That's exactly what West Penn Vice President R. G. MacDonald did recently in a speech before Bituminous Coal Research, Inc. MacDonald, whose company has a penchant for making history (witness its record with the 1957 EEI Sales Promotion Awards), tackled the subject, "The Impact of Electric Heating on Power and Coal Consumption."

First outlining the community of interest between the coal and electric utility industries, MacDonald went on to point out the direction which future growth for both must take: "When we analyze available possibilities, there is only one application which can . . . give us the growth we are determined to experience, and that is electric house heating."

The West Penn executive then ticked off a few more pertinent points for the coal people, but they could just as well have been counseled to the electric utilities. Among them:

- The "coal by wire" market has a total potential larger than all others. At West Penn, an electric heating saturation of 21% would double the present sales of kwhrs to homes and farms.
- There's more in the pie than meets the eye. Not only will electric heating be big-ticket business (70 billion kwhrs by 1970) in itself, but the utility that gets it is virtually assured of getting 100% of the cooking, water heating and clothes drying load as well.
- Only two groups of people are worrying about the cost of electric heating—our competition and us. The customers aren't, and there is no earthly reason why we should overly concern ourselves about its being greater than that of other heating systems. "We would be the first to agree that generally electric heating does cost more than gas. But this problem is no different from the ones we faced when we started selling refrigeration, electric cooking, water heating or clothes drying. We sold these to a significant segment of our market by stressing customer benefits, such as better performance, cleanliness, automatic features, improved safety, comfort and a host of others. In the same way, we can sell this finest of all house heating systems."
- Don't write off the old-home market. True, most electric heating today is going into new homes, but improved insulation technology and electric heating equipment, such as the room-type or zonal heat pump will help overcome insulation and installation obstacles, and enable us to capture more of a share of this old-home market.
- Make a concerted effort to encourage the insulation industry to work with and for us.
- Cooperate with the suppliers of electrical heating equipment at all levels. (A point which will be covered extensively in Electrical World's forthcoming Third Electric Heating and Heat Pump Conference in New York, June 5-6.)
- Join Live Better Electrically's Gold Medallion Homes program. (Also to be covered at the EW conference.)

Finally, MacDonald called on the coal industry—and this applies ever so strongly to utilities—"to draw to the maximum upon our imagination and know-how, and go forward in a unified effort to make 'coal by wire' for heating one of the most sought after commodities in America. Let's go forward together to make history instead of simply recording it."



TEN-YEAR DEVELOPMENT will call for $121-million expenditure by Alabama Power along 230 miles of Coosa. Besides 675.2-Mw generating capacity, dams will provide flood control. Transportation locks could increase potential

Coosa Highlights Hydro Happenings

Alabama Power Co's groundbreaking marks first major river development by private resources. In the Pacific Northwest, companies will place 1,444 Mw on the line this year

A ten-year program for completely developing the head of the Coosa River got under way officially April 26, with the groundbreaking for Weiss Dam by Alabama Power Co. This event marks the first time that a utility has undertaken the full development of a major river.

Of equal importance is that the Coosa is the only major river that has ever been de-authorized for federal development and turned over to private enterprise. Alabama legislators actively backed the company's plans in the state where federal power is a competitive factor.

Overall program for the development calls for expenditure of $121 million during the next ten years. Alabama Power will construct four new hydro plants and raise an existing one. These plants plus two other existing company installations will provide seven dams to utilize the 440 ft of head on the 230-miles from Montgomery, Ala., to Rome, Ga.

In addition to the 675.2 Mw of electric power that will be available from the complete river development, the dams will stabilize river level for commerce and provide substantial flood control storage as well as large quantities of water for industry and cities.

These factors "will tremendously enhance the industrial potential of the Coosa Valley and adjacent areas," said Thomas W. Martin, chairman of the board, Alabama Power. He predicted that "by 1975 new industries with a total investment of not less than $73 million will locate within the development area and that existing industries will make expansions involving not less than $40 million."

Accompanying this expansion will be the associated business and employment potential. Another benefit will be the recreational opportunities provided by the hundreds of miles of shoreline.

Alabama Power began developing the river's potential about 1910. By 1928 three projects were completed: Lay, Mitchell, and Jordan dams. Further development was delayed due to the depression and war. Then in 1945 the Rivers and Harbors Act prevented Alabama Power from continuing and authorized government development.

In 1953, however, the people in the Coosa and Alabama river valleys requested the company to consider further improvements. With this encouragement the company restudied the river and filed a preliminary permit with the FPC a year later. FPC could not act, though, because of the previous law, so the company issued statements that stimulated public interest and resulted in the passage of the necessary legislation—by unanimous vote. Subsequently, FPC granted a preliminary permit and then a license on Sept. 4, 1957.

The legislation and license require the company to provide a substantial, continuous series of pools; provision for future locks; and economically feasible flood control storage. Moreover, the first dam was to be started within one year after the license date, and all dams completed within ten years from the start of the first dam.

All dams are of the concrete-spillway, earth-embankment design. Weiss and Kelly Creek will have considerable storage for flood control, while the other three dams will be mainly run of river.

Weiss Dam, named in honor of F. C. Weiss, vice president in charge of engineering and construction for the company, will have an ultimate capacity of 84 Mw in three units and cost $30 million. It should be completed within 36 months.

Next in schedule is Kelly Creek, which will be started in '59 and require 48 months work. It will have

three units with a capacity of 125.1 Mw and cost $35 million.

Lock 3 Dam, costing $20 million, will have three units for a total capacity of 72.6 Mw. The smallest dam, Wetumpka, will have a capacity of 44 Mw in two units, costing about $15 million.

Final project in the overall plan is the raising of Lay Dam. It presently has six units with a total capacity of 81 Mw. When the dam height is increased, two 48-Mw units will be added, raising the total to 177 Mw. These additions to Lay Dam will cost $26 million and require 36 months to build, with a completion date of mid '67.

When these five projects are completed, Alabama Power will have fully developed the head of the river. In so doing, 421.7 Mw will be added to the system at a cost of $121 million. These additions will increase the Coosa River capacity to 675.2 Mw, including the existing 72.5-Mw Mitchell Dam and 100-Mw Jordan Dam.

Although this program will provide many benefits, it will not develop the full potential of the river. The one thing lacking is locks for transportation, said Martin. He urged all people attending the groundbreaking to support congressional appropriations for locks, so that ultimate potential of the river may be realized.

Projects Needed in Northwest

Despite the fast tempo of present hydro development in the Pacific Northwest, new projects must be started to meet loads expected after 1964. This was the view of Paul B. McKee, Pacific Power & Light Co president, at a Northwest Electric Light & Power Association meeting held recently.

Power companies in the region will place a record of 1,444 Mw on the line during 1958, he said. The companies have 2,488 Mw of generating capacity under development.

These firms and other agencies in the Northwest Power Pool "are engaged in the greatest hydro-electric power supply program ever undertaken by any region in the U. S.," McKee said. Power companies and local agencies together have 5,347 Mw under development. Federal projects under construction will add 2,686 Mw to the pool, he added.

Pelton Project Ceremonies Slated . . .

While Rains Slows Portland GE Dam

Portland General Electric Co's $25-million Pelton hydro project, long delayed by litigation which went as far as the U. S. Supreme Court, is now complete and will be dedicated May 24. Meanwhile, at the company's North Fork dam (lower cut), the unruly, rain-swollen Clackamas River flooded the powerhouse working area for the third time last month.

The Pelton dam produces 120 Mw and includes a three-mile fish ladder—the world's longest—and ski jump spillway. The thin 204-ft high concrete arch dam straddles the Deschutes River in central Oregon. The North Fork project is about 60% completed. It is the major structure in PGE's $20-million Clackamas development. Capacity will be 53 Mw.

AEC Nears First Fusion Goal

The Atomic Energy Commission has taken the wraps off three more approaches to the goal of producing electric power through controlled thermonuclear fusion.

Dr Arthur E. Ruark, chief of AEC's controlled thermonuclear branch, emphasizes that none of the devices—described at the American Physical Society's spring meeting in Washington—have come even close to producing power. This goal, if reached at all, is still years away.

However, as Ruark puts it, "there is general belief in the American laboratories that the ignition temperature"—the initial goal of the researchers—"will be achieved within a few years."

All the thermonuclear experiments disclosed thus far involve attempts to create a hot, full-ionized gas (or plasma) whose temperature is high enough that appreciable thermonuclear reactions will occur.

A basic requirement is raising the plasma temperature to more than 100-million degrees. In addition, the hot hydrogen gas must be isolated from the walls of its containers for tenths of seconds or longer.

The AEC disclosed one approach —the so-called "pinch effect"—in an announcement in January.

This method apparently produced some fusion, but achieved temperatures of only five or six-million degrees and suffered from serious instability of the plasma.

Three more approaches were outlined at the Washington meeting:

• **Stellarators**—Lyman Spitzer, Jr, director of the thermonuclear experiments at Princeton University, hopes that the stellarator—a huge device slated for completion in 1960—will achieve the 100-million degrees needed for a controlled thermonuclear reactor.

With this device, doughnut or pretzel-shaped, cold gas is heated to about one-million degrees by a current passing through the tube. Then a pulsating magnetic field—or "magnetic pump"—is used to multiply this temperature to the hoped-for fusion level. The gas is confined by external magnetic fields.

• **Mirror machine**—This device, described by Dr R. F. Post of the University of California radiation laboratory, consists of a long straight tube surrounded by coils of wire which produce a magnetic field inside the tube.

At each end of the tube, the currents in the coils are made much stronger than in the center. The resulting strong magnetic fields constitute "magnetic mirrors" which deflect particles many thousands of times before they can escape, thus—in theory—raising their temperature to the fusion level.

Post says there's hope that, if self-sustaining fusion reactions can be achieved, the resulting energy can be transformed into useful power without the use of conventional steam turbines.

Although practical problems of direct electrical conversions have not been worked out, Post says the theoretical possibility has been demonstrated. It would involve weakening the confining magnetic fields, or mirrors. This would allow plasma to expand and be cooled—thus delivering its energy back to the magnetic field coils in electrical form.

• **Luce ignition system**—Dr Albert Simon, Oak Ridge National Laboratory, described another device which could be a power producer—but is expected to be more valuable when used in conjunction with one of the other methods.

This machine, first advanced by John Luce, involves injection into a magnetic container of individually charged particles which already are super-hot.

These ions are trapped—in the mirror machine, for example—and will create desired nuclear reactions as they collide with one another. Dr Ruark indicates that AEC is proceeding with still more approaches to controlled thermonuclear reactions, but the main effort is believed to be on the four thus far publicized.

Elk River, Piqua A-Plants Get Go-Ahead

Chairman Lewis Strauss, slated to face his Congressional inquisitors again within a few days, has wheeled up some new evidence to offset Democratic criticism that the Atomic Energy Commission's power program is lagging badly.

AEC chairman announced recently that the commission has tentatively approved arrangements under which two agencies—at Elk River, Minn., and Piqua, Ohio—will buy steam from government-built reactors. Steam costs wouldn't exceed those of a commercial conventional steam plant in the area.

Commission has notified Joint Committee on Atomic Energy that it has reached a basis for agreement with Nuclear Products Erco Division of ACF Industries, Inc, and Rural Cooperative Power Assn of Elk River for construction of 22,000 kw (e) boiling water reactor fueled by a mixture of thorium and uranium oxides. Completion is slated for October, 1960.

Under the arrangement, AEC would provide some $11,450,000 in development, construction and training and test operation of the reactor. A maximum of $9,269,000 of this amount will go to ACF under a cost type contract.

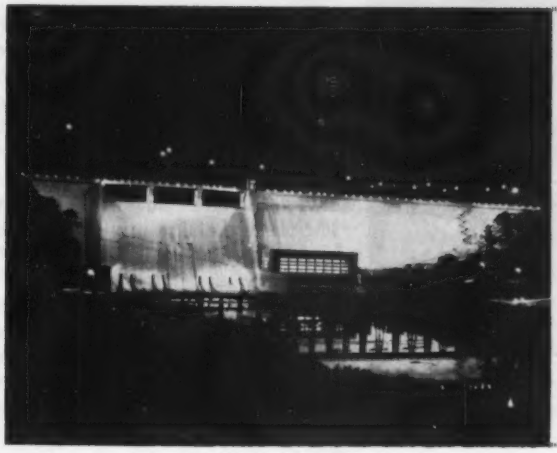
Federal government will retain title to the reactor. RCPA will provide the site and conventional turbogenerator and related facilities, and will operate the entire plant for five years as part of its system.

At the same time, the commission announced agreement on a similar proposed arrangement with the City of Piqua, Ohio, and the Atomics International Division of North American Aviation, Inc.

AEC will provide some $13.2 million in federal aid for research, development, fabrication and construction of a 12,500 kw e reactor moderated and cooled by a high boiling point hydrocarbon.

Both of the arrangements are subject to Congressional disapproval within 45 days.

Strauss is expected to cite these proposals and another recent one involving Carolinas-Virginia Nuclear Power Associates to refute claims for a "crash" program.



From Norris Dam beginnings . . .

TVA At a Glance

Total investment	$2,109,000,000
Power Operations	
Investment	$1,711,000,000
Revenues	$235,700,000
Total sales (kwhr)	57,000,000,000
Peak demand (Feb. 17, '58-kw)	9,418,000
Generating capacity (March 1, '58-kw)	
29 hydro dams	3,727,000
15 steam plants	6,467,000
Customers of 151 distributors	1,471,000
Average annual home use (kwhr)	6,023
Average residential rate (¢)	1.15

Note: Figures from TVA reports for fiscal '57 unless otherwise noted.

To today's power status . . .

TVA Is Still an Issue After 25 Years

Next Sunday is the 25th anniversary of the Tennessee Valley Authority, the largest electric utility operation in the free world.

Even before Franklin D. Roosevelt signed the TVA Act in 1933, a sizeable library of pro and con views had grown over the disposition of government facilities at Muscles Shoals, Ala. Since then, the books, articles, and extracts from the Congressional record about the agency have grown almost in proportion to the system's growth.

The issue that has kept TVA in front of a many-hued spotlight has been federal vs. private enterprise in the power field.

As Admiral Ben Moreell, chairman of the board of Jones & Laughlin Steel Corp, put it for the private side:

"I believe that all public power which is subsidized by tax funds, whether on the federal, state, or local level, is economically and morally wrong. The hazard of economic waste is not so great when state and local governments undertake such activities provided they pay all local, state and federal taxes. But the federal government . . . is an all-powerful monopoly with unlimited taxing power, plus the power to devalue the currency by issuing printing-press money."

The pro-TVA view of Gordon R. Clapp, former board chairman, is: "This issue . . . is a favorite battleground for doctrinaires who place profit from ownership above service . . . Against them are arrayed consumer groups who see water power sites as a public asset, not (to be) wasted by small-scale developments or benefits diverted from consumers."

An Era of Growth

In the past 25 years, TVA has grown from a nucleus of the Wilson Dam at Muscles Shoals to a system consisting of 29 hydro projects and 15 steam plants. The Wilson Dam was preceded by government construction of two nitrate plants and three steam plants at the site during World War I. The TVA Act authorized completion of the dam. Norris Dam (above) was the first started after 1933. Four other hydro projects were built by the Army Engineers; 14 by Alcoa.

TVA built 20 dams during its first 20 years. In 1951 the first unit at the New Johnsonville steam plant began turning out 125 Mw. Today, total generating capacity from both coal-fired and hydro plants stands at over 10,000 Mw. The power system now depends 75% on steam.

Currently under construction at the Widows Creek steam plant is a 500-Mw unit. When asked about the trend to even larger units, a TVA spokesman told Electrical World:

"While no special plans have developed for units of larger size than 500 Mw, TVA expects to continue to purchase machines of larger and larger capacity."

He said the big steam unit at Widows Creek will go on the line in 1961. Its increased efficiency will save an estimated $1 million a year in annual coal costs over a comparable power output of the initial New Johnsonville unit.

The agency is keeping personnel abreast of nuclear power developments. Power people and design engineers are participating in projects at Oak Ridge, Argonne, and other Atomic Energy Commission installations. No plans for nuclear stations are underway, a spokesman said, because of the gap between nuclear and conventional power production costs.

In Washington, D. C., there is speculation that, if the AEC authorization bill includes provision for government construction of nuclear power reactors, a likely site for two of three proposed plants would be Oak Ridge. The Oak Ridge reactors would be on the order of 40 to 50 Mw, observers believe, and would supply the AEC installation. This would release power now supplied to the commission by TVA.

"I'm sure there would be no

CONGENIAL ACCORD characterizes board of director relations. From left, Dr Welch, Chairman Vogel, and Jones. They unanimously favor self financing

objection here," a TVA man said, if the authorization bill led to a nuclear power plant located in the region.

The agency now supplies about 56% of its power to defense installations. Municipalities, rural electric cooperatives, industrial customers, and two small power companies receive the remainder of an annual output now at about 60 billion kwhr. The distributors' systems cover an area of 80,000 square miles, almost the size of England.

Possible expansion of this service area is the crux of the controversy over two measures before Congress. The bills provide for financing of future TVA projects through the marketing of bonds. Critics maintain that the version the Senate passed in its last session would permit TVA to blanket an additional 25,000 square miles of territory. The House version would go farther by holding expansion to merely "economic transmission distance."

The House bill has been reported by the House Public Works Committee, but the chairman—Rep Cliff Davis (D-Tenn.)—of the subcommittee handling the legislation has not asked the Rules Committee for a hearing on granting a rule because of his precarious situation on votes. He is out now trying to count enough favorable noses to get the bill up. Regardless of his chances, Davis will take the bill to the floor for a showdown.

He figures he has plenty of time before the session is out and does

The Father and the Falterer

Sen George Norris

George W. Norris is the name that heads the list of men to whom books about TVA's accomplishments are dedicated. A Nebraska Republican, Norris confounded GOP leaders by untiring espousal of measures—including TVA—often embraced by colleagues across the aisle of the Senate.

His interest in federal river development traces back to Teddy Roosevelt. It was not until the early Twenties, however, that Sen Norris entered the battle of Muscles Shoals, the site of the war-born nitrate plants and a partially completed hydro dam. For a decade Norris thwarted first an offer of auto-maker Henry Ford and later bid by American Cyanamid Co to buy the facilities.

Norris delayed action until support for federal development evolved.

By 1942, when the photo (left) was taken, Norris had long carried the title "Father of the TVA." He died two years later.

Sen Kenneth Douglas McKellar, as chairman of the Appropriations Committee during the Thirties, had an important bearing on TVA legislation. His attitude, though, was parochial.

It was on the eve of World War II that a feud began. The War Production Board had asked the agency to speed construction of the Douglas Dam. But McKellar didn't want it built at the proposed site. He used his office as chairman to hold it up.

After Pearl Harbor he withdrew his objection. It took a long time, though, for the political

Sen Kenneth McKellar

wound to heal. He introduced a series of amendments to block TVA. These were defeated.

It hurt his sense of patronage that a Senator should not have a say over appointments and construction affecting his own state.

To view McKellar purely as an enemy of TVA is a mistake, say TVA backers. He was a staunch supporter in the turbulent Thirties, even if from a narrow viewpoint.

not want to make his move until he thinks he might have a chance of passage.

The TVA board is solidly behind bond financing and against area limitation. The legal division says:

"TVA has always opposed a legislative limitation on territorial expansion on the grounds that TVA's service area has been stabilized, that legislative action would be more apt to lessen than to increase this stability, and that arbitrary lines could not accommodate the minor territorial adjustments which might be necessary in the future. TVA has also argued that its legal authority to expand, even though not utilized, encourages lower rates and better service in the surrounding areas."

Two of the board members await congressional action. Confirmation of the appointments of A. R. Jones, former Kansas State Corp Commission chairman, and Dr. Frank J. Welch, on leave as University of Kentucky dean of the College of Agriculture, still is before the Senate.

Coexistence Upheld

Board Chairman Herbert D. Vogel since his appointment in 1951 has sought to stem criticism, which comes from a "failure of those outside the valley to understand the comprehensive nature of TVA's total program," he told a Guntersville, Ala., meeting recently.

"There is no sound reason why public ownership and private ownership of power facilities should not operate side by side," he said. "There is work enough for both to do."

But critics, while admitting the efficiency of the agency's vast power operation and conceding that TVA should not be put out of business, still bring up the key issue of federal vs. private power.

The U. S. Chamber of Commerce, for example, recommends sale of TVA's power facilities to local groups, either private or public, in the region. Power company spokesmen urge stronger congressional control over the agency, service area limitation, repayment of the taxpayers' investment, and payment of taxes and interest that electric power companies must bear.

Power in the Region's Future

G. O. WESSENAUER, Manager of Power, Tennessee Valley Authority*

G. O. Wessenauer

One pressing problem this region has faced is the inability to offer employment to its growing population. As a result, many of its people have migrated. This region has a higher birth rate than much of the nation; yet its population has been growing at a slower rate due to out-migration.

What will the region seek to attain in the next 25 years? Certainly, with the region's advantages of climate and resources, and the attention which the states are giving to out-migration, it is reasonable to assume that it will aspire to a population growth rate that is at least equal to that of the nation.

Population which the local electric systems presently serve is a little more than five million. Applying the growth rate of the Census Bureau for the U. S., we may expect the population in 1983 to be about 8 million. How much electricity will these eight million people require in 1983?

While we cannot determine what amounts will be needed, it may help to speculate on possibilities.

Today's average industrial worker in this region uses about 30,000 kwhr annually. It is within the realm of possibility that 25 years from now each industrial worker in the area may require as many as 90,000 kwhr a year. Total electricity required by industry could approach 100 billion kwhr in 1983, or six times industrial use now.

Average use by commercial customers is about 50,000 kwhr today. With increasing popularity of electric heat, air conditioning, and good lighting, plus new developments certain to come along, average use of these establishments could double in 25 years. Commercial and service customers could require as much as 30 billion kwhr a year—a ten-fold increase—25 years from now.

The farm of the future may need on the average as much as 35,000 kwhr a year in addition to use in the farm home. Farms in the region are expected to number 270,000 in 1983 so that annual use for production and processing of farm goods may be approaching 10 billion kwhr.

A population of 8 million people will mean about 2.5 million households compared to about 1.3 million today. Residential use averages 6,500 kwhr a year now in the region. It is possible that it may be 40,000 kwhr a year 25 years from now, or a total of 100 billion kwhr. This is 12 times present use.

When we total these rough estimates of power needs, we find this region may look to its power system to supply in the order of 250 billion kwhr in 1983. This excludes any use by the Atomic Energy Commission or other large national installations.

If the figure of 250 billion kwhr startles you, let me hasten to point out it represents an increase of only eight times in the next 25 years in comparison with an increase of 20 times since 1933.

We—your local systems and TVA—have a big job cut out for us in the future. We have to face the future with our sights set high.

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* Adapted from a paper presented before Tennessee Valley Public Power Assn., April 17, 1958.

Make Employees Wear Those Safety Glasses

Five men would be blind but for the glasses at left. Here's how one utility keeps safety glasses on a worker's face—not in his pocket

GEORGE J. RUOFF, Safety Director, Central Hudson Gas & Electric Corp, Poughkeepsie, N. Y.

The basic purpose of an eye protection program is to prevent human suffering and the loss of man's most precious gift—his sight.

For two years we at Central Hudson Gas & Electric Corp have emphasized eye protection, and it has paid off. Company accident statistics show effective control of possible eye injury exposure. Lost time due to eye injuries has been reduced. In more important terms, this means that people have been saved from possible blindness.

Safety rules of 30 years' standing have required our employees to wear eye protection during grinding, chipping, and welding.

Generally, these rules served well. There had been only about a half dozen serious eye injuries—all resulting from rule violations. Nevertheless, 15% of all our reported accidents involved the eyes, and many could have been serious but for the narrowest of margins.

Two years ago we reviewed our eye protection program carefully. Our eye accident history indicated that a program cannot rely on an employee's discretion as to when and where to use protective eyewear.

So we tried a new approach. Recognizing that important decisions regarding safety should not be left to an individual's judgment, we amended our safety rules, making them broader and stiffer.

We required all employees who were issued safety glasses to wear them during working hours unless excused by the supervisor. They would be worn by all employees when grinding, chipping, breaking up junk, concrete, or porcelain; when working with acid, lye, solder, compound, or other harmful substances. Dark safety glasses were prescribed for working with sources of intense light. Employees near hazardous work were also required to wear safety glasses.

The job of enforcing the new policy fell squarely on the shoulders of the individual supervisors. The Safety Division of Central Hudson provides the leadership, coordination, and staff services for the entire safety program, but unless the supervisor himself is convinced of the importance of carrying out safety rules, any such program is doomed.

Ernest E. Althouse, vice president, operations, helped sell this program. He said:

"If any one of us could foresee the exact time, the place, and the particular situation which would cause an eye injury, then there would be no necessity to wear eye protection. However, because no one will ever have this information before the fact, it is better to play safe, even to the degree of being overcautious, and to wear the protection all the time."

Support from the Supervisors

We promote cooperation of supervisors in several ways. The goals of the program are stressed constantly in informal conferences at all levels. Accidents—as well as cases where safety glasses prevented injuries—are publicized in departmental reports and the monthly employee bulletin. Supervisors spend two weeks with the Safety Division, learning about the program and its aims. Also contributing to the success of the program is management-labor cooperation, which helps sustain employee support.

In addition, we set up personalized fitting of safety glasses. Instead of leaving it to the storekeeper, we now have seven plano fitting and servicing centers throughout our system. Company personnel who fit these safety glasses are first trained by optical company experts.

Fitting centers are near work areas, and employees are invited to return as often as necessary for refitting or adjustment. If the fitting center cannot satisfy an employee with a good, comfortable fit, a licensed eye practitioner is available at no initial cost to the worker.

Another Pair for Outdoors

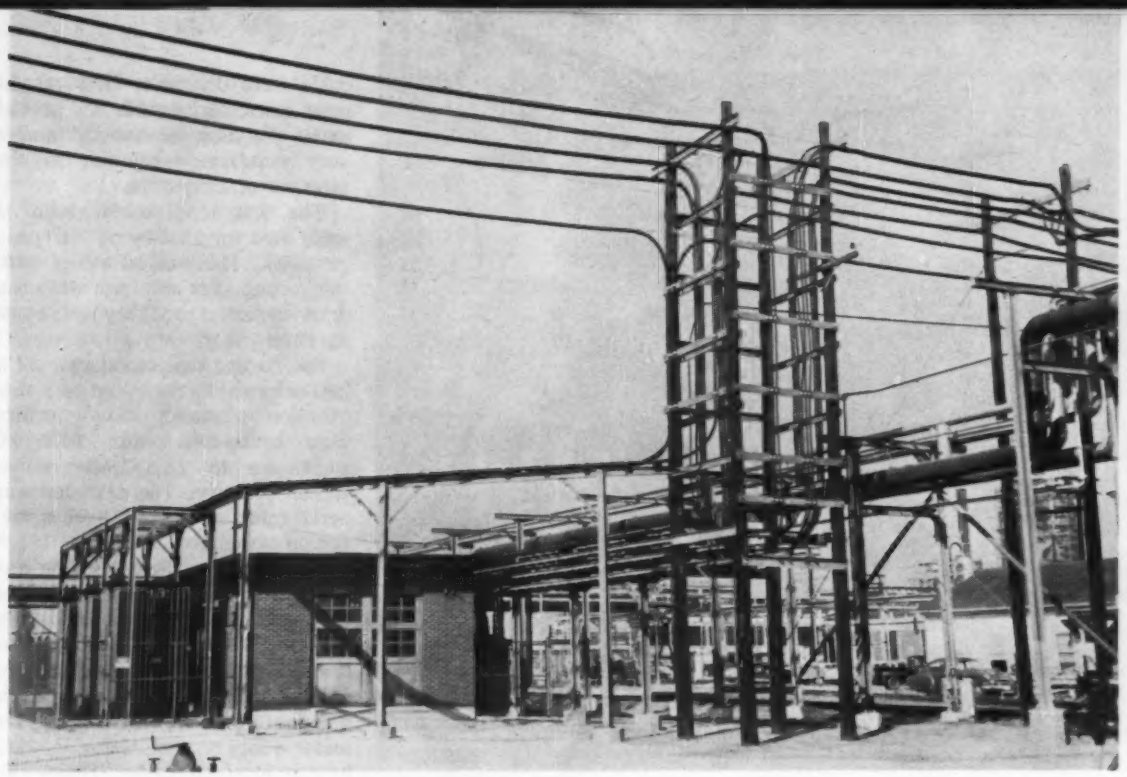
For outdoor work, employees without prescription lenses are issued both clear and dark pairs of spectacle-type safety glasses.

For the employee who wears prescription lenses, only a very light tint is permitted—and then only at his own request. A darker tint would constitute a hazard if he entered an area of low light intensity.

The result of these efforts has been our best record of safe work performance in 25 years.

The Wise Owl Club of America, sponsored by the National Society for the Prevention of Blindness, recently honored the 54th employee of our firm with membership. Wise Owl members are industrial employees who escape blindness by wearing eye protection at the time of on-the-job-accidents. Six citations honor employees whose eyes have been saved more than once.

Today our employees no longer need to be convinced of the importance of eye protection. Beneficial results of our eye protection rule have even created a more open attitude toward other safety rules. The employee at Central Hudson realizes it is not a *company* safety program, but *his* safety program.



Aerial cable replaces open wire distribution as . . .

Refinery Eases Congestion, Corrosion

Cost of stainless steel hardware and bronze deadends is justified by reduction in failures and inspection frequency

M. L. WATTS, Assistant General Foreman, Humble Oil & Refining Co, Baytown, Texas

A modernization program highlighted by aerial cable distribution, corrosion-resistant hardware, and the use of compression connectors has helped solve the twin problems of congestion and corrosion at the Humble Oil and Refinery Company's Baytown, Texas refinery. Instituted as a result of a 10-year expansion program that doubled total demand, the distribution system serves a refinery with a 100,000 kw capacity, 40% of which is purchased from Houston Lighting & Power Co. To maintain uninterrupted service to all refinery units, the modernization had to be designed, constructed and put into service piecemeal.

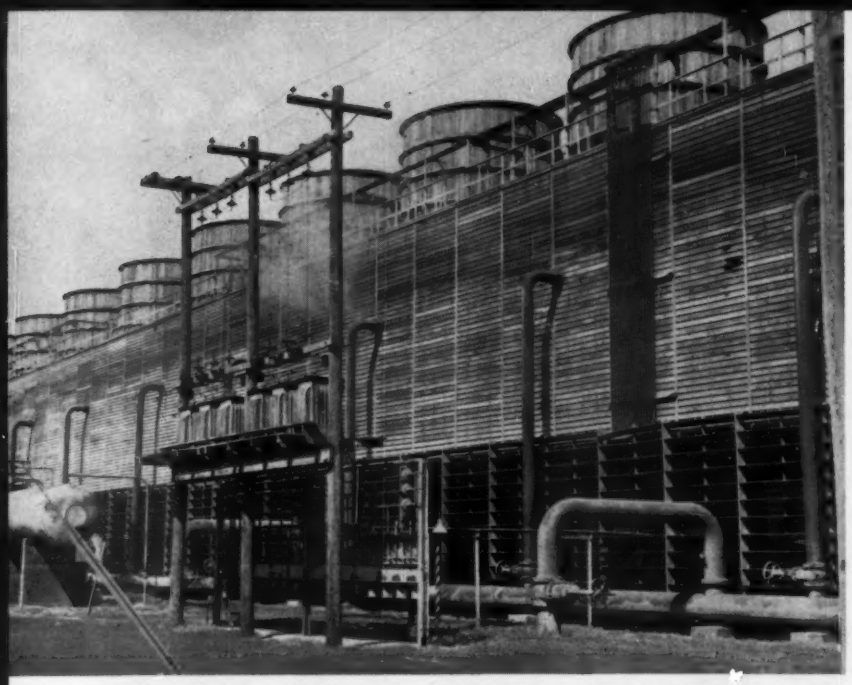
Used both for 13-kv primary distribution and for 2.4-kv secondary distribution, the aerial cable has reduced the congestion of the earlier open wire circuits and diminished the hazard of accidental contact with the numerous cranes used when refinery equipment is taken out of service. Trial installations of stainless steel and bronze hardware have made it possible to lengthen the interval between inspections to a minimum of one year, compared to as little as three months in some areas before this hardware was installed. Using compression connectors to replace bolted types has eliminated connector failures in the corrosive atmospheres common in refineries.

During the 10-year period of the rapid expansion program, trouble was experienced with corrosion and overheated circuits. Connectors were heating and failing. Dead-end clamps and other hardware were failing.

An inspection program was started for periodic examination of each service structure and all corner structures. All connectors, hardware, down guys, static wire, crossarms, and poles are checked and repairs are made in accordance with their urgency.

This inspection program indicated a need for better materials in locations where corrosion is bad. In areas where hydrogen sulphide gas, sulphuric acid fumes, and other chemicals are released to the damp Gulf Coast atmosphere, corrosion is severe. Transformer and service structures are exposed to extreme conditions around cooling towers, where a fine spray of chlorinated water comes in constant contact with power line hardware. When this inspection program was first started it was found that some locations needed inspecting every three months.

As one step toward solution of the corrosion problem, stainless steel and bronze hardware were investigated. Stainless steel was avail-



SPRAY OF CHLORINATED WATER from cooling tower, sulfuric acid, and other chemicals cause severe corrosion of transformer and service structures. Stainless steel cutout cases will be tested to reduce painting and replacement rate

able in certain quantities but at a cost seven to ten times the cost of galvanized steel hardware. The cost of bronze was from three to five times that of galvanized steel.

However, because of the high replacement cost in manpower and materials, and loss of products caused by interruption of service to continuous process units, some stainless steel and some bronze hardware were ordered. Experience with these initial installations has resulted in the use of 18-8 stainless steel for overhead static wires, guys, guy grips, anchor rods, bolts, nuts and washers. Bronze is being used for dead-end clamps and silicon bronze is being used for nuts and bolts.

These materials are giving good service. Their use has lengthened inspection periods to one year and seldom is there need for repairs.

Most of the work required now in the areas where corrosion resistant materials have been used is the painting of transformers and oil fused cutout cases and the replacing of oil fused cutouts. Delivery of stainless steel oil fused cutout cases has been promised by one manufacturer and some of these should soon be in service on a trial basis.

Bolted type connectors have also caused some concern, particularly on aluminum to copper connections. Examination of some of these connectors after they had failed showed that corrosion had eaten the tin from the spacer and electrolylic action caused the connector to fail.

The bolted connectors have been replaced with compression-type connectors. Compression-type connectors have been used on copper to aluminum connections for several years and there has been no trouble with them. There are still many bolted-type connectors on the distribution system but they are being changed out as fast as possible.

Underground Cable Considered

As the system load grew it became apparent that it would be necessary to take steps to reduce the number of open wire lines. The possibility of going underground was considered but in most areas there were so many obstacles it would have been necessary to go 10 to 12 ft deep to find space for distribution facilities. Also, where underground facilities are installed in the refinery area they must be encased in red concrete to protect against digging machines.

In some cases underground cable has been installed where neither open wire construction or aerial cable were desirable. However, in most cases, aerial cable has proved to be the most economical and a very satisfactory solution to the problem of congestion.

The first aerial cables installed were used for 13.8-kv power house get-away. These aerial cables were single-conductor and each was on a separate messenger. They were comparatively short.

Later some three-conductor 13.8 kv feeder cables were run to a distribution substation. These cables were continuous from 13.8 kv switchgear to 13.8/2.4-kv transformer primary. The next step was aerial cable for the 2,400-volt distribution system.

Some of our worst congestion was in the area containing a battery of pipe stills charging crude oil. A new 12,500-kva substation was located in this area. The substation is fed by three 13.8-kv circuits, each a 3/c, 23-kv, 300-Mcm, compact sector copper conductor, PILC bronze armored cable. These circuits feed through three 6,250-kva transformers to the 2.4-kv bus. One of these transformers is a spare and is normally deenergized.

There are seven 2.4-kv circuits feeding pipe stills and cooling towers in this area. Each of these circuits consists of three, single-conductor, 750-Mcm copper cables, Butyl rubber insulated, Neoprene jacket, spun to a one-half inch stainless steel messenger.

All open wire construction has been removed from the area except the transformer structures that serve refinery operating units. These transformers are 2,400/440-v units and provide service for motors, motor operated valves, and electric desalters. One single-phase transformer provides service for lighting and instrumentation. The oil fused cutouts are used for larger motors. One spare circuit ties to a transfer switch at each structure and can pick up the load in case of cable failure. It is also used while inspecting cable and circuit breakers.

When refinery operating units are taken out of service for overhaul, numerous mobile and crawler cranes are required for handling tube bundles, pipe and other heavy equipment. With open wire circuits much time was spent installing and removing rubber hose on lines so that cranes could work near conductors

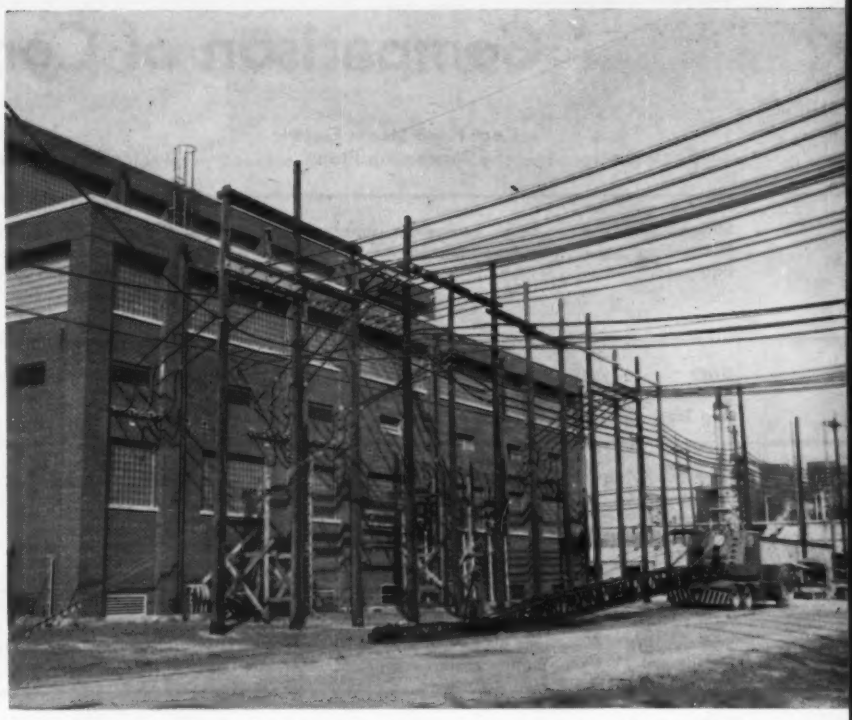
with safety. It was not unusual for a crane to swing something into the lines and burn them down. In some instances lines were taken out of service to permit the operation of mobile equipment in certain areas.

Aerial cable construction has proved safer for mobile equipment. It is not vulnerable to the elements. It is safer for linemen to work and it gives better overall appearance.

Modernization of the distribution system has not been restricted to the feeders. In many places, where refinery units have been remodeled and enlarged, the old open-type transformer and service structures have been replaced with totally enclosed switchgear and transformers on a concrete slab.

These installations consist of a throw-over switch which can operate from one of two circuits to a common bus. Gang-operated, oil-fused cutouts are connected to the bus ahead of 2,300-v motor starters, 440 volt transformers and a 110-220 volt lightning transformer.

Some of these installations are fed from overhead cable circuits, while others are supplied from underground circuits. The cable circuits, both overhead and underground extend beyond the refinery "battery" limits where they usually tie to open-wire construction.



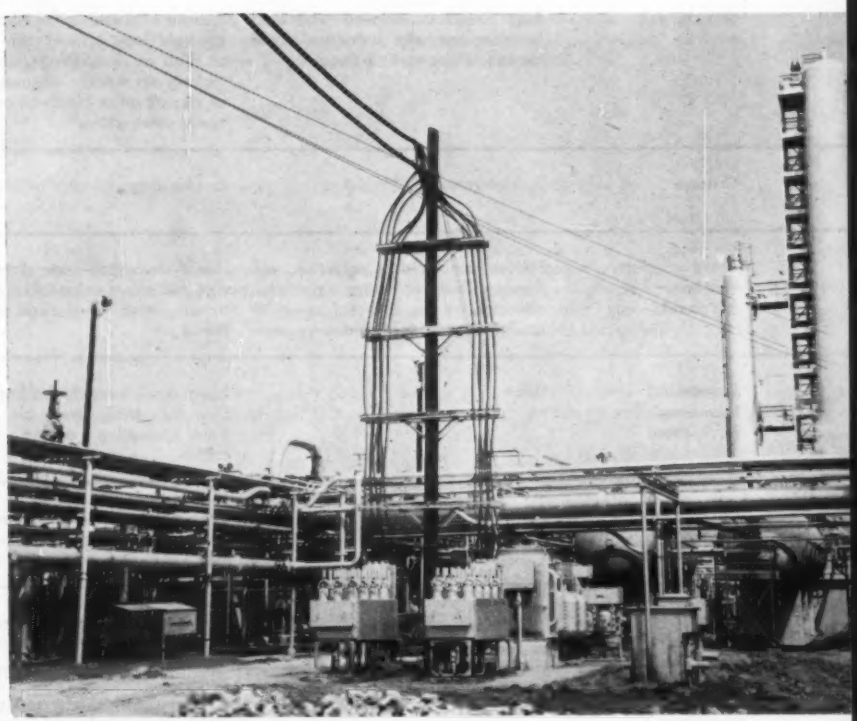
FIRST AERIAL CABLE was 13.8-kv powerhouse getaways. Each single conductor cable has separate messenger. Cable was later used on 2.4 kv lines

Use Double-ended Substations

Several double-ended outdoor substations were installed to relieve overload conditions. These installations consist of two, 3,750-kva transformers fed by two 13.8-kv circuits of 3/c No. 2/0 copper, 23-kv PILC cables with bronze interlocking armor. One of the stations is fed by 3/c polyethylene insulated cable with bronze interlocking armor. These small substations feed nearby refinery units with two 2.4-kv feeders.

All of the 13.8-kv cables on the system have bronze interlocking armor for mechanical protection. All three-conductor aerial cables are spun to a one-half inch, 18-8 stainless steel messenger with 18-8 stainless steel, 16-gauge wire.

One goal has been to have a maximum of two 2.4-kv open wire circuits on any single pole line. With very few exceptions this has been attained, and in many cases there is only one 2.4-kv circuit to a single pole line.



ENCLOSED SWITCHGEAR and transformers on pads have replaced many overhead units. Some are fed from aerial cable, others by underground

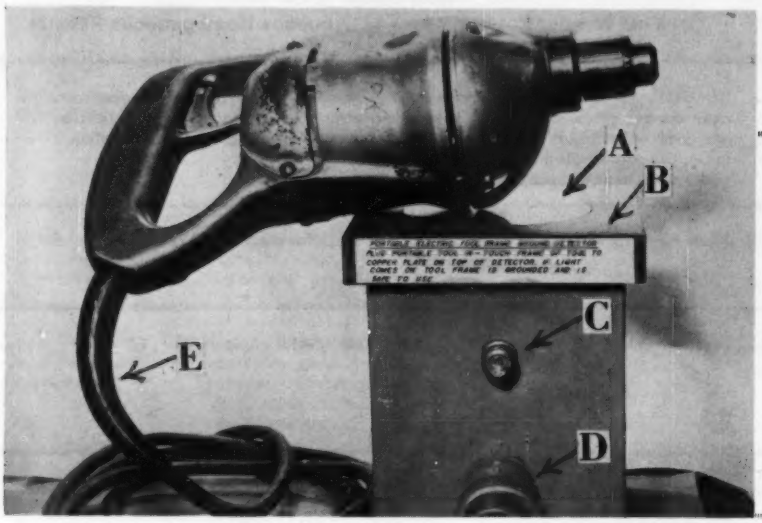
Comparison of Conventional and

Equipment	Coal Fired Steam Electric Generating Plant	Boiling Water Reactor	Pressurized Water Reactor
Steam Generating Equipment	Boiler, economizer, superheater, air heater, soot blowers.	Reactor, reactor water recirculating system, secondary steam generators, reactor control equipment.	Reactor, steam generators, reactor system pressurizer, reactor control equipment.
Draft Equipment and Stack	Forced draft, induced draft fans, ducts, breechings and stack for removal of products of combustion.	Stack for disposal of contaminated air.	Stack for disposal of contaminated air.
Fuel Receiving and Handling Equipment	Car or barge unloaders, feeders, conveyors, scales, breakers, crushers, trippers and bunkers, coal storage yard, scrapers, bulldozer, stock recovery system.	Fuel element storage vault.	Fuel element storage vault.
Fuel Preparation and Burning Equipment	Feeders, pulverizers, fans, exhausters, burners, ignition equipment, combustion control equipment.	Reactor service turntable, fuel handling cranes, fuel element racks and baskets and rack carrier.	Indexing mechanism and handling device for fuel elements.
Turbine Plant and Feed Water Equipment	Turbo-generator and accessories, condenser and accessories, circulating water intake equipment and accessories, feed water heaters, and feed pump.	Turbo-generator and accessories, moisture separating devices, circulating water intake equipment and accessories, condenser and accessories, primary feed water heaters and pumps, secondary feed water heaters and pump.	Turbo-generator and accessories, condenser and accessories, circulating water intake equipment and accessories, feed water heaters and feed pump.
Structures	Steel skeleton enclosed with brick walls or sandwich type walls, with louvers, windows and doors.	Reactor and accessories housed in an air tight steel sphere with air locks or seals at all openings, and a ventilating system for absolute control of air; all other buildings of conventional construction.	Reactor and steam generators housed in air tight steel shells with seals at all openings and penetrations; all other buildings are of conventional construction.
Cranes	Turbine room.	Turbine room, reactor building.	Turbine room, reactor building.
Plant Waste Disposal	Bottom ash or slag collection, ash transport, air or water separator, ash storage or disposal area or equipment, boiler blow-down system.	Liquid waste collection system, storage, filters, demineralizer, concentrator, permanent storage tanks and burial pit.	Liquid waste collection system, storage, filters, demineralizer, concentrator, permanent storage tanks and burial pit.
Spent Fuel Handling Equipment	None	Spent fuel baskets, basket carrier, discharge tube, spent fuel storage pool, handling cranes, shipping coffins.	Transfer canal, spent fuel storage pit, shipping coffins.
Decay Heat Removal System	None	Heat exchanger and pumps, emergency heat exchanger and head tank.	No special equipment.
Reactor Shield Cooling System	None	Shield cooling coils, heat exchanger and pumps.	Heat exchanger and pumps to cool reactor pool.
Reactor Auxiliary Equipment	None	Reactor water coolers, demineralizer and pumps, condensate demineralizer, wash and decontamination solution make-up and storage.	Blow-down cooler, demineralizer and pumps, wash and decontamination solution make-up and storage.

Nuclear Plants Shows Differences

Sodium-Graphite Reactor	Fast Breeder Reactor	Aqueous Homogeneous Reactor
Reactor, reactor coolant circulating system, intermediate heat exchanger (sodium to sodium), secondary sodium circulating system, economizer, steam generator and superheater, reactor control equipment.	Unmoderated sodium-cooled reactor, reactor coolant circulating system, intermediate heat exchangers (sodium to sodium), secondary sodium circulating system, steam generators, reactor control equipment.	Reactor, pressurizer, steam generator, reactor fuel circulating system, reactor fuel dump tank, reactor instrumentation.
Stack for disposal of contaminated air.	Stack for disposal of contaminated air.	Stack for disposal of contaminated air.
Fuel element assembly equipment, new fuel storage cells.	Fuel element storage vault.	No special equipment.
Fuel element handling cask (loading and unloading), fuel connect cells.	Offset handling mechanism, transfer rotor and transfer elevator (loading and unloading).	Fuel preparation and concentration control equipment.
Turbo-generator and accessories, condenser and accessories, circulating water intake equipment and accessories, feed water heaters and feed pump.	Turbo-generator and accessories, condenser and accessories, circulating water intake equipment and accessories, feed water heaters and feed pump.	Turbo-generator and accessories, moisture separating devices, condenser and accessories, circulating water intake equipment and accessories, feed water heaters and feed pump.
Reactor and sodium loops in gas tight concrete cells; all other buildings are conventional construction.	Reactor and primary loops in air tight steel shells, steam generator and secondary loop in concrete cells; other buildings are conventional construction.	Reactor and primary loop in gas tight concrete cells; turbine building can be conventional construction.
Turbine room, reactor building.	Turbine room, reactor building, shipping crane.	Turbine room, reactor building.
Liquid waste collection system, storage, filters, concentrator, permanent storage tanks and burial pit.	Liquid waste collection system, storage, filters, concentrator, permanent storage tanks and burial pit.	Liquid waste collection system, storage, filters, demineralizer, concentrator, permanent storage tanks and burial pit, radioactive gas hold-up system.
Fuel cleaning cells, spent fuel storage cells, shipping coffins.	Fuel element decay pit, fuel element cleaning and disassembly, shipping coffins.	Reactor fuel purification system, fuel waste concentration, shipping containers and coffins.
No special equipment.	No special equipment.	Fuel storage tank cooling system.
Shield cooling coils, heat exchanger and pumps.	Inert coolant gas circulating system, heat exchangers.	Shield cooling coils, heat exchanger and pumps.
Sodium fill, drain and flush system, inert gas systems, cold traps and filters for sodium cleanup.	Sodium handling systems, inert gas systems, cold traps and filters for sodium cleanup.	Wash and decontamination solution make-up and storage.

Prepared by: V. H. Simon, Mech Engr, Pioneer Service & Engr Co, Chicago, Ill.



Avoid Trouble

SIMPLE, LOW-COST DEVICE for checking grounding circuit of portable-tool frame consists of 6 x 6 x 6-in. sheet metal box housing a 1½-v battery. The ⅛-in. copper plate (A) is recessed in a fiber top (B) and connected to the battery which is in series with a 3-v lamp (C), the ground-wire terminal of the polarized plug receptacle (D), and the grounding conductor in the 3-wire cord (E)

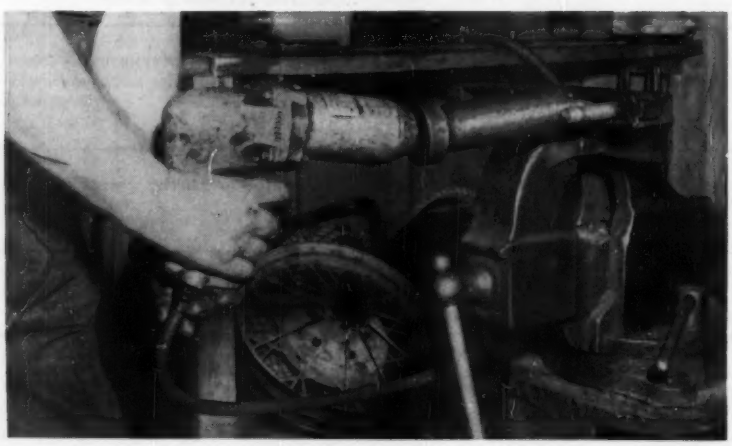
Cut Costs with Simple Tester for Slide-

L. E. SHOEMAKER, Master Results Man, Tanners Creek Station, Indiana & Michigan Electric Co, Lawrenceburg, Ind.

A simple, portable tester for checking rotation of slide-wire motors after cleaning or changing bearings is a low-cost device that saves time and money. It is designed for testing 1-ph 2-winding induction motors.

The tester consists of a 4⅛ x 2⅛-in. conduit box with a blank cover, four terminals on a strip, and a 1-ph double-throw toggle switch connected to a 1-mfd 200-v condenser and a 120-v ac receptacle. The terminal block can also be shielded with a fiber or plastic cover.

When connected to the tester, the motor can be run in either direction by flipping the toggle switch. If the



Don't Scrap

Damaged cable clamps and nuts don't have to be scrapped. They can be salvaged and re-used by employing an ingenious method devised by a field crew of Duke Power Co's construction department.

Instead of scrapping clamps with damaged threads, the Duke crew achieved substantial savings with a quick and effective method of chasing clamp threads and tap nuts. A simple jig was designed, provided

by Checking Grounds of Power Tools

T. E. PEAY, Master Maintenance Man, Kanawha River Plant, Appalachian Electric Power Co, Glasgow, W. Va.

A simple, low-cost ground-checking device can be used to prevent electrical shock from 110-v portable tools. It was developed for checking tools having 3-conductor cords and polarized plugs intended to ground the portable tool frame when connected to a polarized receptacle.

To check the grounding circuit, the tool is laid on a copper plate on top of the testing device, and the tool-cord plug is inserted in the receptacle on the face of the box. If an extension cord is used, both cords should be included in the testing circuit.

If the frame grounding circuit is correct, the 3-v lamp above the receptacle will light. However, if the resistance of the grounding circuit is 3½ ohms or more, the pilot lamp will not light. Failure of either the lamp or its battery is safe, because no light indicates something wrong.

The device can easily be adapted to making a similar check of tools equipped with 2-prong plugs and alligator grounding clips.

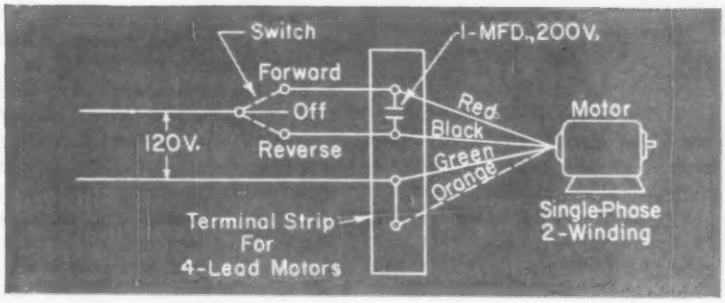
This tester should not be allowed to create a false sense of security, for some tool frames might not be grounded as a result of poor contacts at the receptable or a break in the receptacle's grounding circuit.

The device required 15 man-hours for construction; materials cost about $7.50.

Wire Motors

motor does not function properly, it can be removed and installed correctly in about 30 min.

Material cost for the device was about $2; assembly time, 1½ hr. It saves about 15 man-hours a year at Tanners Creek Station.



Damaged Cable Clamps—Salvage Them

with separate rectangular channels to hold each of the three different sizes of clamps. The jig is held firmly in a vise by means of a welded baseplate, and the clamp slipped into its proper channel.

An air Impactool, fitted with a special adapter, is used to chase the threads. This adapter was made from a length of pipe capped with a threaded flange at one end. The flange is broached to fit the ⅝-in. square driver of the tool, and the opposite end of the pipe bored to seat the threading die.

This set-up produces smooth clean threads on the extra-long studs, and the power tool quickly reverses drive rotation to run the die off the threads. After chasing operations, nuts can easily be run on the threaded studs, which range from ½ to 1⅛-in. diam.

Excellent results are also obtained in tapping damaged nuts. For this application, a hexagonal nut is force-fitted over the square end of the tap. Any size nut that fits the hexagonal sockets for the tool can be used. The opposite end of the socket is slipped over the tool's square driver. The nut to be reworked is simply placed in a hexagonal socket of suitable size, the socket held in a vise, and taps run into the threads.

(*More How To on page* 66)

Screw Jack Speeds Pulling of Through Bolts

A screw jack facilitates pulling of through bolts from poles on the Tennessee Valley Authority system. The tool is particularly useful where through bolts are bent or bound by twisting of the pole or crossarm.

The screw jack has a threaded puller that slips under the head of the bolt. Pressure is applied with a hot-stick ratchet wrench against a compression member made of aluminum pipe having a 2.469-in. inside diameter.

Conductive Paint Halts TV Interference

P. A. BULLOCK, System Superintendent, T&D Operations, Indiana & Michigan Electric Co, Fort Wayne, Ind.

A conductive paint used on 27 and 33-kv lines has proved a long-lived and successful method of eliminating TV interference.

The paint was applied in 1952 to 13 circuit miles of lines that were causing TV interference. This trouble could not be eliminated by the usual maintenance methods of tightening line hardware, proper bonding, and adequate separation of metal parts. The lines had been built prior to the introduction of radio-proof pin-type insulators.

The interference was traced to the small air gaps between the tie wire, conductor, and uncoated insulator. Applying the paint to the insulator tops, conductors, and tie wires has effectively shunted out these air spaces and eliminated all TVI from this cause. This treatment is effective after five years, and the paint is still adhering well to the conductor and insulator.

Since the paint was applied, the company has received no complaints of TV interference which can be traced to arcing tie wires. It may be argued that this experience is the result of the increase in the TV signal field strength since 1952 by the addition of new TV stations, taller transmitting towers, and their increased radiation. Nevertheless, the conductive paint is preventing TVI and contributing to customer satisfaction in several fringe reception areas 60 miles from different TV stations.

Lab Study Okays Two Solvent Classes

W. A. GARRISON, Chemical Engineering Section, American Gas & Electric Service Corp, New York, N. Y.

An extensive laboratory investigation of solvents for cleaning and degreasing has resulted in the recommendation of two classes of solvents for general use. They are:

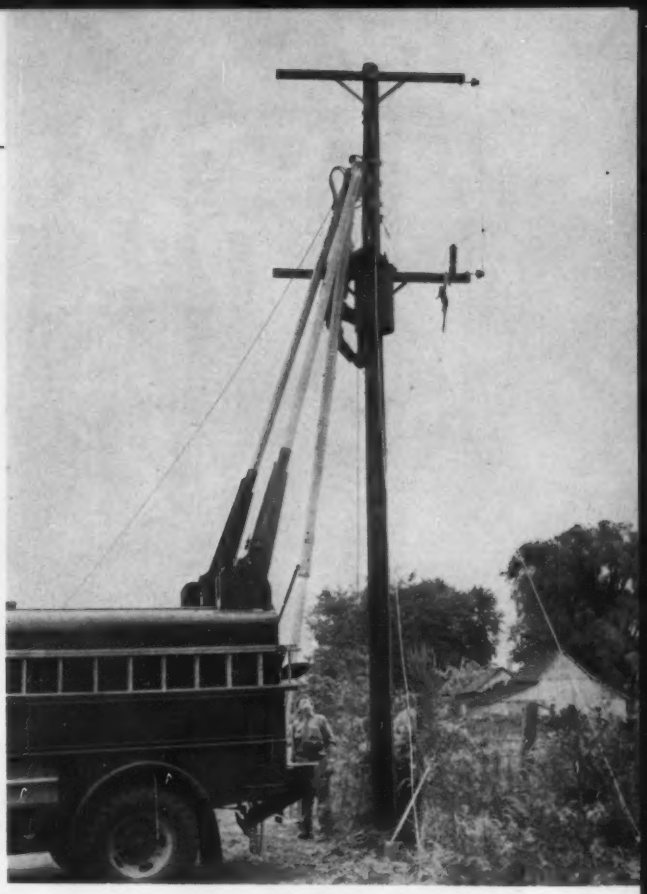
- Petroleum solvent—where fire hazard and drying rates are not particularly troublesome.
- Inhibited methyl chloroform—where fire hazards exist and drying is essential.

From a health hazard standpoint, both solvents have a desirable maximum allowable concentration (MAC) of 500 parts per million, compared with carbon tetrachloride's undesirable MAC of 25 ppm. Nevertheless, when either solvent is used in a confined area or where ventilation is poor, a fresh air mask should be worn at all times.

Undue exposure to the fumes or direct contact with the skin should be avoided when using the recommended solvents. Adequate ventilation, light, protective clothing, fire-fighting equipment, approved supply containers, wiping cloths, etc, must be provided at all times.

Equipped Small Crews Effective

Hydraulic derrick, mechanical digger make 3-man line crew more efficient and economical than larger ones



HYDRAULIC DERRICK on each truck was the major factor in making practicable the reduction of line crews to three and four-man units. One man can ready the derrick in only a few minutes. Trucks have large crew cabs

GEORGE W. PEAK, Director of Organization Planning, Public Service Co of Indiana, Plainfield, Ind.

Equipping each line crew with a truck-mounted hydraulic derrick and a mechanical hole digger has enabled Public Service Co of Indiana to cut the size of the basic line crew, increase the number of crews, and begin to realize an estimated annual saving of $170,000 in crew costs.

One man can ready the hydraulic derrick for work or return it to its traveling position in a few minutes. A manually positioned derrick took three men from 15 to 30 min to put it in operating position. It can be handled safely by smaller crews on heavier jobs and gets work done faster. Having a useful life of about 8 to 10 years, it is expected to pay for itself in labor savings in about two years.

The mechanical hole digger can be transported on a comparatively light-duty trailer. For digging, it can be suspended from the derrick, held by the winch line, and driven by the power takeoff from the truck transmission. It can be operated by two men and digs holes in less than 5 min. Its labor savings are also expected to pay for the digger in about two years.

Specifications for the new truck equipment and plans for placing it on the trucks were developed by the company's transportation superintendent, L. L. Clark. On line trucks, the hydraulic derrick and mechanical hole digger did not pre-empt space for the usual tools. The trucks, larger than required for the reduced crews, have cabs that can accommodate a larger complement for an occasional large job.

Found Trucks Lacking

The study resulting in increased mechanization was undertaken when it appeared likely that more crews would be needed. For the purposes of the study, it was assumed that the same number of contractor crews, company line servicemen, and local representatives would be continued in service. The work of 70 line crews in 30 districts was covered. These districts had from 2,200 to 35,000 customers, and the 70 crews ranged from three to nine men. The study showed that most jobs could be completed in fewer man-hours by a three-man crew. The study also revealed that the lack of truck equipment prevented splitting large crews temporarily for the quick restoration of service in an emergency.

In reorganizing the line force, about half of the crews were made three-man rather than four-men crews, and supervisors were made available for running combined or augmented crews. Crews were increased from 70 to 103, a process yet to be completed. When jobs are too big for three men, the crew is augmented by assignment of needed men or by combining crews. Here are the advantages of the smaller crews:

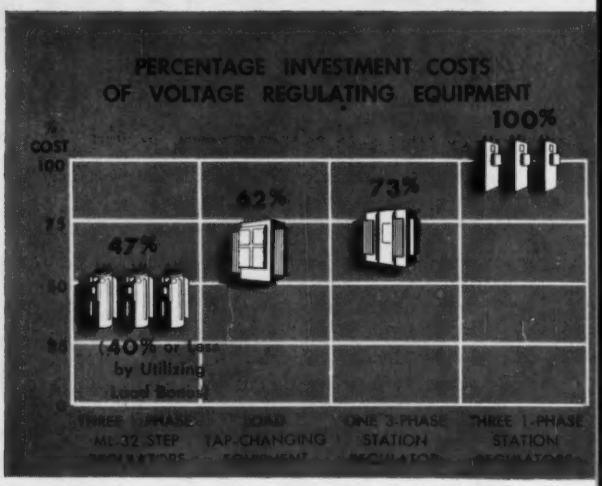
1. Lower cost. More work can be done by the same number of men, or the same volume of work can be done by fewer men.

2. Faster service restoration. In an emergency, service can be restored more quickly by two small crews than by one large one.

3. Reduction of overtime work.

(*Continued on page* 70)

New Higher Ratings make...



COMPARE THE COST figures on the chart above and see how the application of ML-32 single-phase regulators can reduce substation regulation cost by as much as 60% compared to other types of regulation.

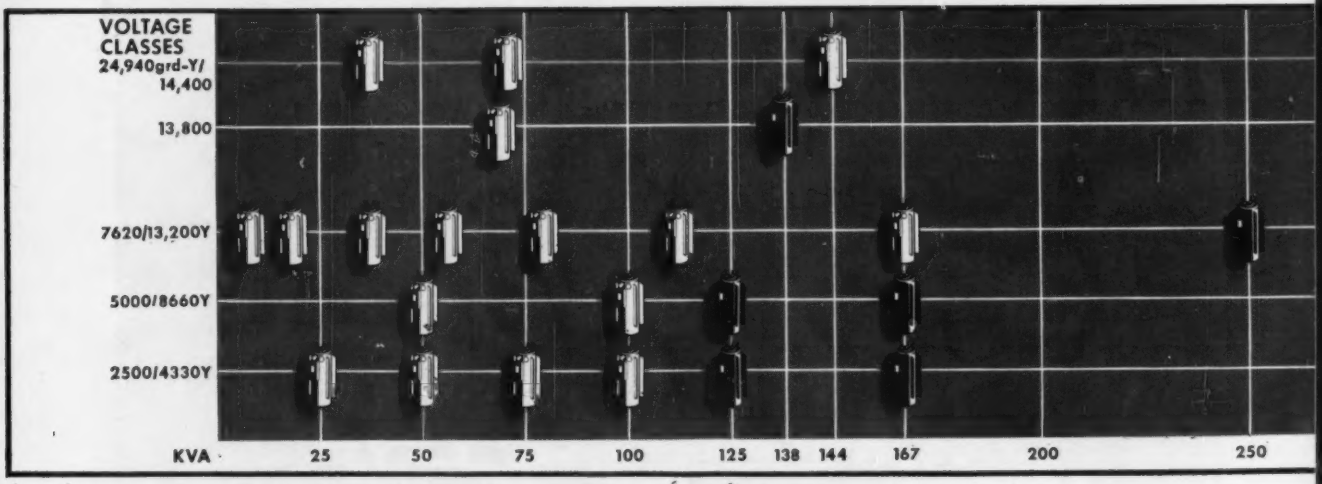
New ratings of G-E single-phase step regulators permit application of ML32's in larger substations . . . Save up to 60% of the cost of station regulation equipment!

The trend is to greater use of low-cost single-phase regulators in substations, and General Electric is meeting the demand. The new extended single-phase step regulator line provides new 125- and 167-kva ratings in the 2500- and 5000-volt classes, a new 250-kva rating in the 7620-volt class, and a new 138-kva rating in the 13,800-volt class for greater substation economies. As much as 60% can be saved on your regulation investment, and you also get individual phase regulation and increased savings through deferred investment in line rebuilding.

In addition, at reduced regulation ranges, a new Load Bonus (extra current capacity) of ***480 amperes*** (up to 160% of rated current) is now available on 2500-volt units rated 75 and 100 kva.

Remember, the price of substation regulation, using ML-32's, is less than that of other types of regulation. You'll want to know more about the quality and economy available in the ML-32; write to Section 423-25, General Electric Company, Schenectady, N. Y., or contact your nearest General Electric Apparatus Sales Office.

General Electric Regulators Cost Less On The Line



THE EXTENSION OF ML-32 RATINGS to 250 kva (new ratings shown above in black) gives you a new opportunity to provide low-cost regulation on your growing feeders. Growing load, plus demands for economy, can be met when you specify ML-32's for your substation regulation. They cost you less on the line.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Small Crews Effective (*Continued from page 67*)

This is accomplished by completing work in fewer man-hours, particularly in emergencies, which often occur after regular working hours.

4. Improved public relations. Customers see crew men spending more time at productive work instead of standing around waiting, which happens with large crews.

5. Better employee attitudes. Men fully occupied develop better work habits and work attitudes.

6. Better employee pay. Small crews mean better average pay for employees as the percentage of journeymen linemen is higher. This has brought about a general upgrading of crew personnel, which is expected to produce increased job interest and more flexibility in assignments.

Jobs are assigned to small crews so as to make maximum use of manpower flexibility. Crews are made up of men qualified for climbing, a three-man unit consisting of one line working foreman and two linemen. A four-man crew has one line crew supervisor (non-union), two journeymen linemen, and a driver-groundman. When two crews are combined, a crew supervisor directs the group, and a driver-groundman helps serve the journeymen lineman on the poles.

In answering objections to the proposed change, here are the facts which the company pointed out:

1. Crew work capacity will not be reduced very much as most large crews have only two journeymen linemen.

2. Most jobs assigned company crews are not large construction projects which, for the most part, are handled by contract crews.

3. Although small crews use more calendar hours, they complete a job in fewer man-hours.

4. Although small crews are combined occasionally for large jobs, the savings from the creation of the small crews more than offset the extra cost of mechanizing them and upgrading personnel.

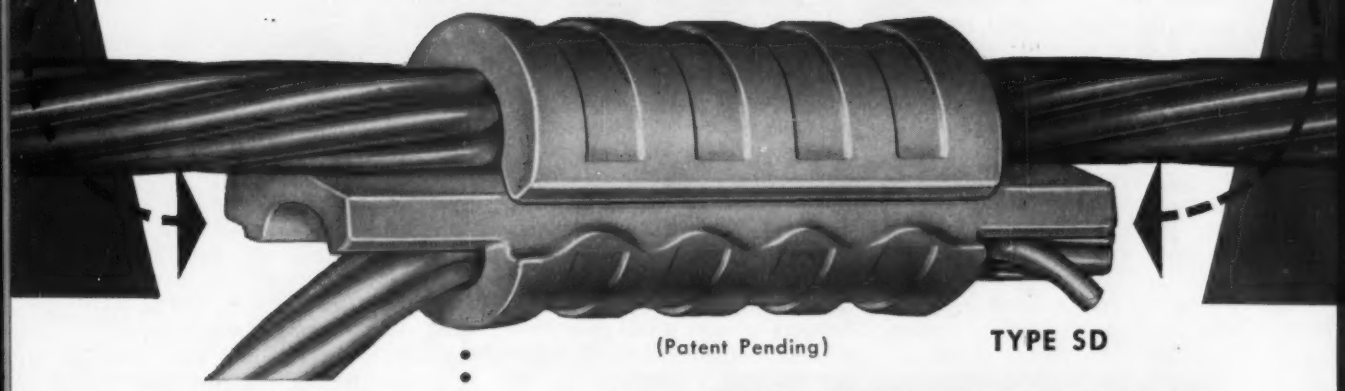
In the transition to smaller crews, employees are not discharged. Surplus driver-groundmen and groundmen are being carried on crews as excess personnel until they can be upgraded to journeymen linemen in their present combination or transferred as journeymen linemen to jobs outside line work.

Estimated Annual Saving with Small Line Crews

	Division "A"	Division "B"	Division "C"	Total
Line crew personnel employed	117	208	109	434
Line crew personnel required	101	168	100	369
Excess personnel	16	40	9	65
Estimated annual payroll saving	$58,240	$145,600	$32,760	$236,600
Additional trucks required	9	13	11	33
Estimated Annual cost of additional trucks	$18,000	$26,000	$22,000	$66,000
Estimated annual net saving	$40,240	$119,600	$10,760	$170,600

HOLE DIGGER is essential to the efficient operation of the reduced crews. It can be operated in conjunction with the hydraulic derrick and is transported on a light-duty trailer, leaving room in the truck for usual amount of tools

Exclusive New DRIP-GUARD SEPARATOR



(Patent Pending) TYPE SD

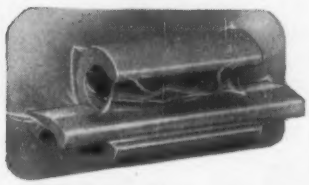
in BLACKBURN 6-Frame Tap Connector

- **Assures Separation of Conductors**
- **Provides Needed *Extra* Protection on Bi-Metallic Connections**

Type SF Recommended for Aluminum to Aluminum

This Blackburn 6-Frame Tap Connector assures complete separation and protection of the conductors. The Drip-Guard is unnecessary for this application.

Both Designs Available *Pre-Filled*

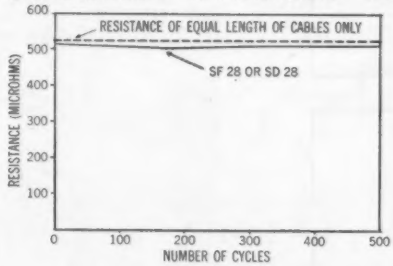


Type SD or SF may be ordered pre-filled with Blackburn's superior oxide-inhibiting compound, Contax. Pre-filling eliminates the possibility of an installation being completed without inhibitor.

Write for samples

LIVE BETTER ELECTRICALLY

CURRENT CYCLING TEST TELLS THE STORY



Current Cycling Test Conditions:

1. Cables: 4 Stranded Copper; 2 ACSR.
2. Cable operating temperature: 125° C.
3. Cycle: 2 hours "On", 1 hour "Off".
4. Length of connection: 24 inches.
5. Resistance of equivalent length of wire: 522 microhms.
6. Cables were wire-brushed, but no protective compound was used.
7. Curves represent an average of seven tests.

This rugged Blackburn design provides protection for conductors from both galvanic corrosion and physical damage. The Blackburn Drip-Guard Separator, plus the completely enclosed tap, prevents corrosion products from bridging the gap between the copper and aluminum conductors. Copper wire now can be used as main or tap without corrosion damage to the aluminum conductor.

In addition, the superior Blackburn design, which incorporates external channels parallel to the tap hole, assures uniform encirclement of both conductors when compressed.

Shot-blasted surfaces protected by an oxide-inhibiting film insure oxide-free connectors at jobsite.

For Pump Storage Projects . . .

Unit Must Fit System Conditions

H. H. ROTH, Allis Chalmers Mfg. Co., West Allis, Wisconsin

The application of generator-motors to pump turbines requires considerably more coordination between the electrical and hydraulic units than is normally required.

The generator-motor must have ratings both as a generator and as a motor. These ratings are usually different in kva and power factor, and sometimes in voltage and speed.

The units have to operate in either direction of rotation. And the designer must also consider the pump-turbine torque requirements for starting and the starting method best suited to the particular system.

Power characteristics of the unit may differ considerably depending on whether it is used as a pump or turbine. This depends on considerations of head, rpm, and capacity.

For a given head, power characteristics may be varied by changing the speed and runner diameter. For a given pump-turbine there is a definite rpm at which the output as a turbine will approximately equal the power required to operate it as a pump. This however is usually not a synchronous speed.

The best unit for a given application is determined by a study of each unit as applied to the system under consideration. Water used for generating peaking power must be replaced during the hours in which surplus power is available from thermal plants.

Because load is lightest on Saturdays and Sundays, more pumping can be done on weekends. Replacement of stored water is therefore considered on a weekly cycle basis. Pumping capacity is thus determined by the amount of water to be pumped over a weekly cycle and the number of hours when power is available for pumping.

Generating capacity is determined by the amount of peaking power required. The appropriate unit may differ considerably in its characteristics as a motor and as a generator. It is usually feasible to operate at approximately unity power factor when pumping, while the pf when generating is dictated by system requirements.

Kva rating of the electrical unit depends on both pumping and generating requirements. Because the pumping load will be relatively constant, a motor rating which permits operating at maximum load without overloading should be selected. When generating, however, some overloading might be considered in order to carry short peak loads.

A two-speed generator-motor may be considered where there may be an extreme variation in hydraulic head. Within limits, a synchronous machine may be built which can operate at either of two synchronous speeds to obtain the best hydraulic efficiency for the available head. Such a unit will cost about 85% more than a single-speed machine so that there must be a considerable gain in efficiency to justify its use.

Voltages Differ

The voltage rating as a motor may sometimes differ from its rating as a generator. This is due to the impedance drop of the transmission line being in different directions with the two operations. The two-speed Tennessee Valley Authority Hiwassee unit is rated 13.8 kv as a generator and 13.5 kv as a motor.

Starting the unit for pumping is one of the most important considerations in a pumped storage plant. Several starting methods are available. Choice among several available methods is determined by a number of considerations.

To start as a synchronous motor with a minimum shock on the system it is necessary to first unwater the pump.

The Hiwassee reversible pumped storage unit is rated 70 Mva as a generator and 102,000 hp as a motor. It is started from a 50% tap on the main transformer secondary as shown in Fig 1. Because the transformer secondary is delta connected, the applied reduced voltage is 60 electrical degrees ahead

(*Continued on page* 74)

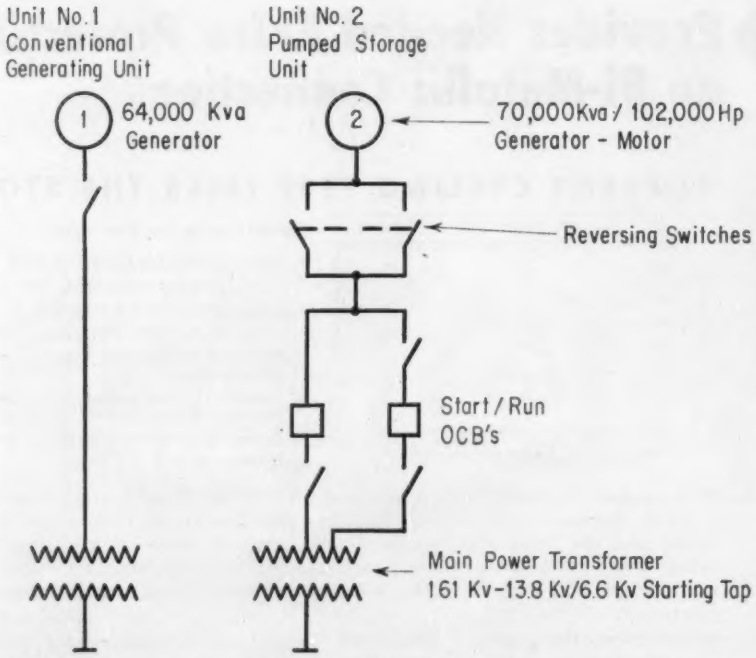
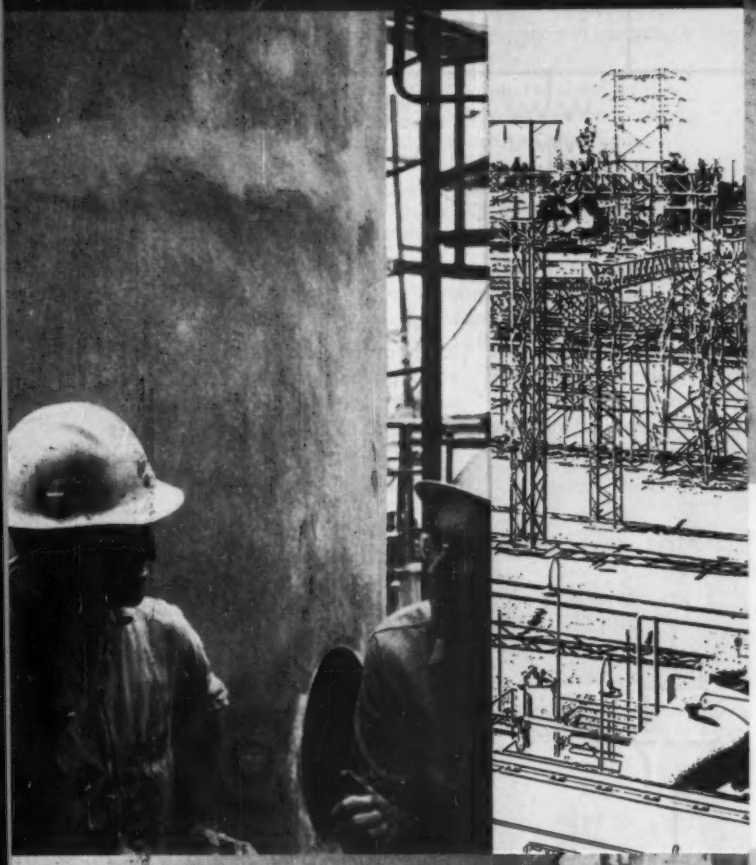


FIG 1—Reduced voltage is used for starting the Tennessee Valley Authority's Hiwassee pump storage unit as a motor. Tap on main transformer power is used



WHEN you consider expansion . . .
. . . the most important
investment you can make is in
the creative ability of men.

FLUOR

The Fluor Corporation, Ltd.
Engineers & Constructors
2500 S. Atlantic Blvd., Los Angeles

Pump Storage Unit (*Continued from page 72*)

of the transformer normal secondary voltage. At about 110 sec after closing the starting breaker the motor reaches approximately synchronous speed and is pulled into synchronism by field application through a polarized relay which applies the field at the most advantageous part of the slip cycle.

After synchronizing, transfer is made to full voltage. A delay of about one second is introduced between the opening of the starting breaker and the closing of the running breaker. This is about the time required for the motor to decelerate the 60 degree lead of the starting voltage.

Reduced voltage starting is relatively simple. Time required for the starting cycle is about four minutes from the release of compressed air into the draft tube until the unit is on the line and pumping.

Full voltage or across-the-line starting can also be used. This is the simplest method as shown in Fig 2. It might be used for small and moderate size units, provided the system can supply starting kva without undue voltage disturbance.

Average kva drawn from the system with across-the-line starting is about 250 to 350% of rated kva, depending on the size and speed of the unit. In a multi-unit plant the most severe shock to the system will occur when starting the first unit. When starting subsequent units, the motors already on the line may temporarily be overexcited to furnish a part of the required reactive kva of the incoming unit.

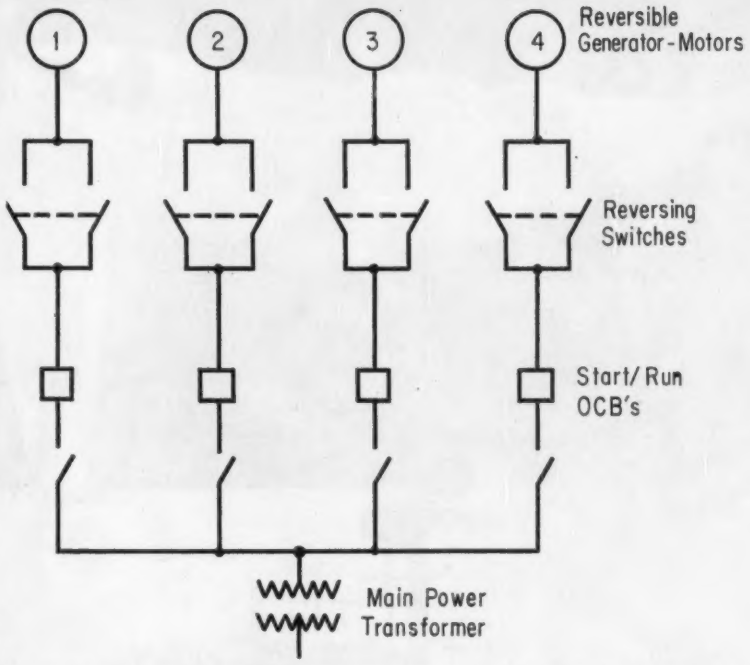


FIG 2—Across-the-line starting is the simplest method. It is used where systems are large enough to supply starting kva without system voltage disturbance

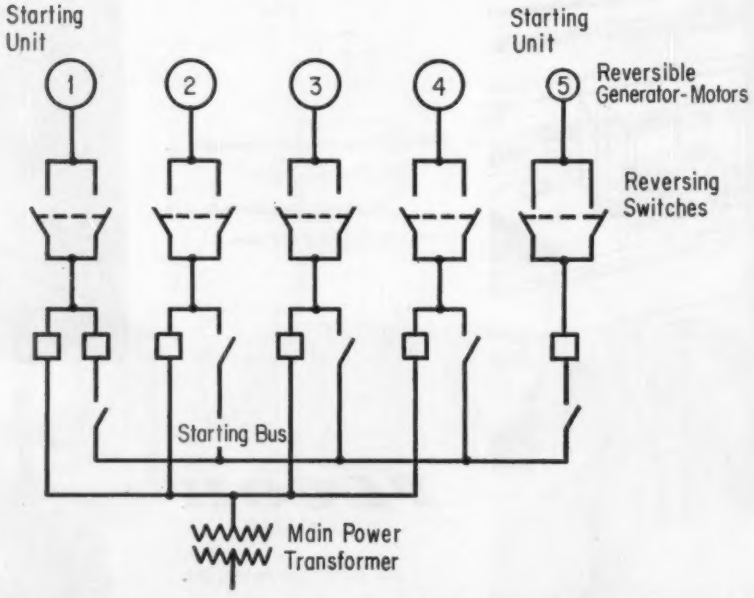


FIG 3—With synchronous starting two machines are tied together electrically at standstill. One starts as a generator and drives the other unit as a motor

Synchronous starting is usually used for large units. With it, two of the machines are electrically tied together at standstill and excitation is applied to both. One unit is then started as a generator. The second will come up to speed as a motor in synchronism with the first. After reaching synchronous speed, both units are synchronized with the system after which the generating unit is tripped off and stopped and may then be used to start another unit.

In Fig 3, unit No. 1 is the starting unit for units 2, 3 and 4. After these units are in operation, units 1 and 5 are started.

Unit 5 is a relatively small machine and is only large enough to synchronously start unit No. 1. It will have a rating of 20 to 30% of the other machines. It may have other special characteristics, such as high short circuit ratio and low reactance, in order to meet the requirements of starting large units.

Synchronous starting can also be used in a single-unit plant provided it is possible to isolate a generator and transmission line from the system. Separately driven exciters are necessary for each machine.

There is another important ad-

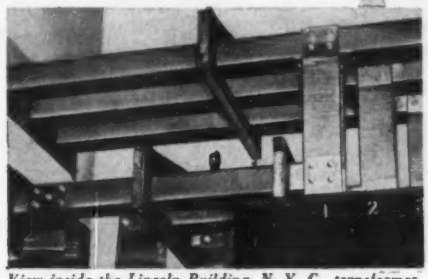
(*Continued on page 78*)

BEST WAY TO FEED A SKYSCRAPER

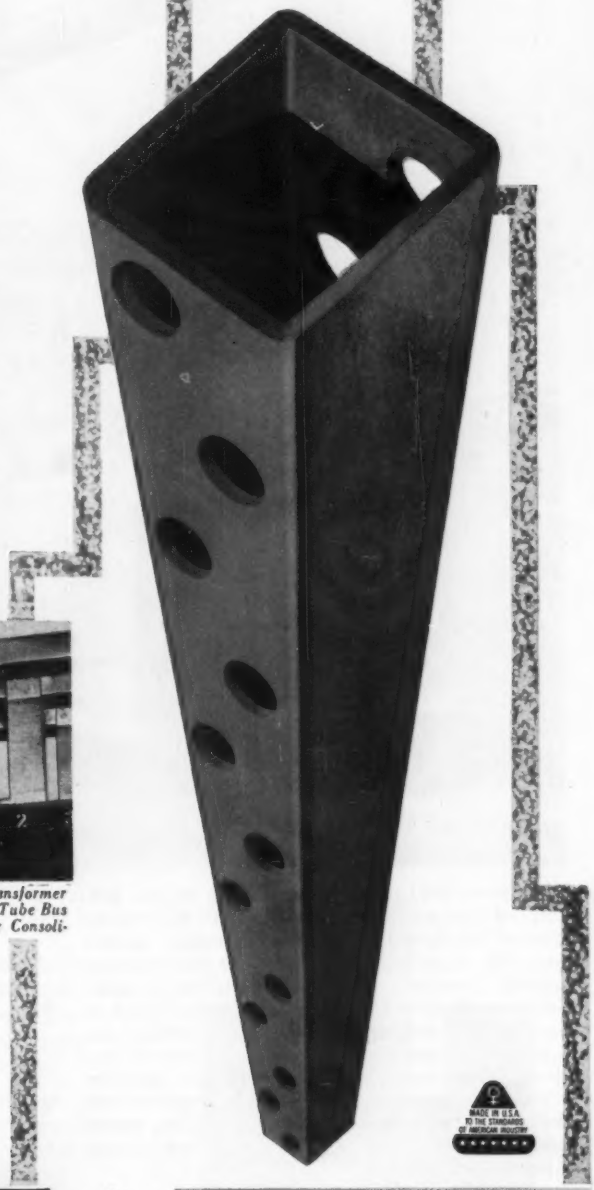
New York's Lincoln Building gets all its power needs through Chase® ventilated square copper tube bus conductors

In the heart of mid-town Manhattan, the 53-story Lincoln Building is supplied all of its electrical power through a distribution system built around Chase Ventilated Square Copper Tube Bus Conductors. In the building's transformer vault, 6 high-rated transformers and four services, each capable of handling 3,500 amps, make a total of 14,000 amperes of current available to meet the building's needs.

Whether you measure your power requirement in thousands of KVA or in lesser units, you can best handle it with Chase bus conductor. Chase Square Copper Tube Bus is available in unventilated from 1″ square x ⅛″ thick and ventilated from 2″ square x ⅛″ thick to 11″ square x ½″ thick. Current capacity runs as high as 14,200 amps at a 50°C. rise above 40°C. ambient for ventilated bus. Ask your nearest Chase representative for specific recommendations on handling your exact current supply problems with Chase Square Copper Tube Bus Conductor. You can reach him locally, or at Waterbury 20, Connecticut.



View inside the Lincoln Building, N. Y. C., transformer vault showing Chase Ventilated Square Copper Tube Bus Conductor. Installation designed and made by Consolidated Edison Company of New York.



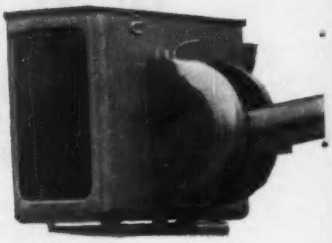
Chase
BRASS & COPPER CO.
WATERBURY 20, CONNECTICUT
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

CHASE ELECTRICAL CONDUCTORS
are available in a variety of shapes to suit every power-carrying need.

The Nation's Headquarters for Brass, Copper and Stainless Steel

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L.I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

Reach



Keep your field office or workshop on the job! Rugged INTERNATIONAL chassis and big-volume METRO® Van bodies put men and materials "on location" with plenty of working space. All-steel bodies up to 16 ft. 7 in. long are factory-matched to highly maneuverable truck chassis. Walk-in, walk-through integral cab and body afford easy access to driving compartment and van area. Low load floor reduces awkward lifting. What's more, bodies are three-way protected in critical areas against rust. Ask your INTERNATIONAL Dealer today about one of these easy-handling METRO units. GVW ratings to 16,000 lbs. Delivered to order ready for your job.

Four-wheel-drive INTERNATIONAL Trucks with special bodies and equipment help your crews reach any job *—on, off or above the highway!*

Extra power! Short stroke INTERNATIONAL six-cylinder engines deliver more power for fast highway cruising, off-highway pulling and driving auxiliary equipment.

INTERNATIONAL TRUCKS

any job!

INTERNATIONAL Trucks with all-wheel-drive give you go-anywhere traction and power to run your auxiliary equipment. Wide choice of light-duty chassis with factory-installed Service-Utility bodies.

Cab comfort! Seats are over five feet across. There's plenty of room for efficient operation of controls. Minimum-distortion Sweep-Around windshield gives safer view. No "knee-skinning" doorway projections—entry and exit are easier.

All-truck built! Rugged INTERNATIONAL Truck chassis for special bodies are job-matched for lasting service. Entire unit can be delivered fully assembled by your INTERNATIONAL Branch or Dealer to save you time and money.

Remember: INTERNATIONAL Trucks cost *least* to own!* See your INTERNATIONAL Dealer for a truck that's right for your job!

**Signed statements in our files, from fleet operators throughout the U.S., back up this statement.*

cost least to own!

INTERNATIONAL HARVESTER COMPANY, CHICAGO
Motor Trucks • Crawler Tractors
Construction Equipment • McCormick®
Farm Equipment and Farmall® Tractors

Pump Storage Unit

(*Continued from page* 74)

vantage of using a small unit with several large ones. After construction of the pumped storage plant has progressed to the point where filling of the upper reservoir can be started there may be no method of using synchronous starting of any unit since there is no water in the upper reservoir. This will be true if the plant is located on a small stream or if the upper reservoir is located where no stream flow exists.

Because synchronous starting cannot be used without sufficient water in the upper reservoir to drive one unit as a turbine generator, the small machine can be used to fill the upper reservoir. A large amount of off-peak pumping will be required to fill the upper reservoir and this will necessitate daily starting of a pumping unit over a considerable length of time. This precludes using one of the large units until sufficient water has been accumulated in the upper reservoir to permit synchronous starting, but the small unit may be used for this purpose with a minimum of system disturbance.

The generator-motors require certain modifications. Full or reduced voltage starting necessitates the use of a continuous amortisseur winding in the rotor in order to provide the necessary torque.

When synchronous starting is used the damper winding does not have to be of the continuous type except on the unit to be started last by means of reduced voltage. But all generator motors have continuous damper windings to allow reduced voltage starting if required.

As a generator-motor must be capable of operating in either direction of rotation, special consideration of rotation, ventilation and bearing lubrication are important.

To minimize the break away torque when starting as a motor, oil is introduced between the thrust bearing surfaces at standstill at a pressure sufficiently high to establish an oil film.

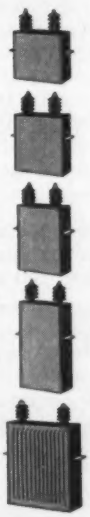
All reversible pumped storage units require a means of phase reversal to provide for both directions of rotation. This may be accomplished by using either two oil circuit breakers or two disconnect switches, interlocked to prevent closure simultaneously.

99.6%
SURE

Of all manufacturers of power capacitors only C-D puts each and every unit through a full voltage energization test before shipment to you. This is why C-D delivers an unbeatable 99.6%-sure performance

PERFORMANCE

in the field.



15, 25, 33.3, 50 and 100 KVAR capacitors for every application with lowest dielectric unit stress and highest major insulation level. Invest your purchasing dollar in internal quality—the only place where it counts. See your C-D representative or write Cornell-Dubilier Electric Corp., Dept. EW5, South Plainfield, N. J.

SPECIFY

*C*onsistently *D*ependable

CORNELL-DUBILIER

POWER-FACTOR CAPACITORS

CORNELL-DUBILIER CD CAPACITORS

Here are the reasons why...

Sylvania Fluorescents give you more light—

at lower cost than all other brands!

Superior engineering makes Sylvania fluorescent lamps better in many important ways . . . makes every lamp a better tool of production and sales to increase your profits.

TODAY, good lighting is more than illumination . . . it is a basic tool of production and sales. Sylvania, with this important premise always at work, offers business and industry a complete line of modern fluorescent lamps that assures efficient lighting . . . provides performance that means maximum service from your present fluorescent lighting system, and a higher return on your investment in the illumination of offices, factories or stores.

Why Sylvania lamps are best

It takes many things to make better fluorescent lamps. That's why ordinary fluorescents cannot match Sylvania lamps for light output, lamp life and dollar-for-dollar lighting value.

The reason? Sylvania builds many important major features into fluorescents . . . all contributing to superior lamp service and greater lighting economy.

Check these many points of superiority. See for yourself why you get more and save more. Notice, too, that Sylvania makes its most important comparisons with other brands . . . not with Sylvania products of the past.

Sylvania fluorescent lamps are as much as 14% brighter

Tests in the laboratory and working installations demonstrate that Sylvania lamps consistently deliver more light.

Equally important, during the past two years, an actual comparison of Sylvania fluorescent lamp performance with that of other brands shows Sylvania to deliver as much as 14% more light, depending on the lamp type.

Thus, you get the maximum light you expect . . . all the light you pay for . . . from the start.

Sylvania's greater maintained brightness means 7 lamps free for every hundred you use

Sylvania fluorescents maintain their greater brightness throughout useful life. For example, at 3,000 hours, in a single-shift operation, 100 Sylvania lamps deliver the light output of about 107 ordinary fluorescents. In effect, you get a dividend of light equal to 7 free lamps . . . more light-per-lamp from the power you pay for.

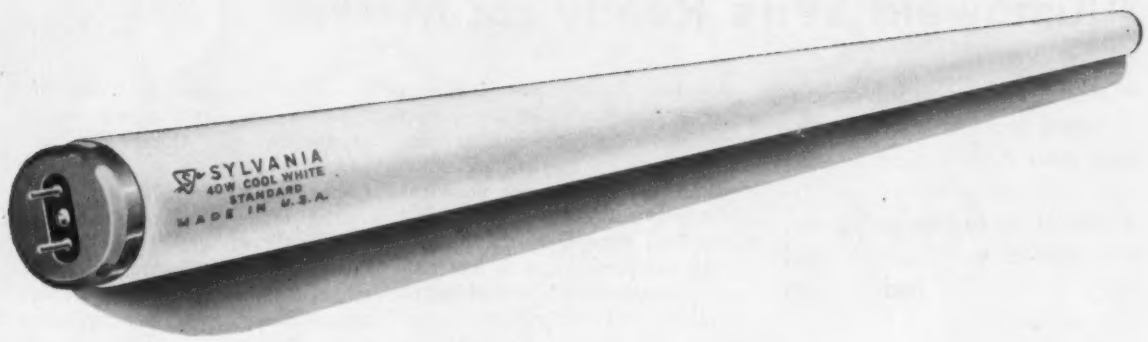
Sylvania welds all bases . . . eliminates faulty lamp contact

Sylvania welds the tube-to-base contact points in all its fluorescent lamps. Other brands use soldered contacts.

By welding, Sylvania completely eliminates the corrosion caused by soldering. Faulty lamp contact so common with ordinary fluorescents is eliminated. As a result, Sylvania fluorescents burn brighter far longer . . . save dollars and time in lamp maintenance.

Only Sylvania's exclusive coating process homogenizes phosphors for maximum brightness

Year after year, Sylvania lamps have delivered more light for a far longer time than ordinary fluorescents because of superior phosphors. In fact, only now are some other brands being introduced with phosphors of a quality which Sylvania has long since improved.



In addition, Sylvania uses an exclusive coating process which more uniformly distributes these superior phosphors throughout the tube. This unsurpassed uniformity is made possible by homogenizing the phosphors—and, in itself, contributes a minimum of 3% greater brightness over other processes now in use.

Sylvania lamps are 99.9% free of performance defects

Every lamp that leaves the plant is subjected to the infallible scrutiny of electronic devices that test and inspect for every possible flaw. One unit, for example, is so critical it can detect, in a fraction of a second, a lamp leak that would otherwise not become apparent until after many months of use. In this way you are assured of the highest lamp quality and performance.

Revolutionary VHO—first lamp to give 250% as much light as a standard tube

The Sylvania VHO (Very High Output) lamp represents a major breakthrough in fluorescent lighting. It produces 2½ times the light output without changing the size or shape of the tube.

The high intensity lighting "punch" of Sylvania's VHO offers new lighting levels that make it practical for the first time to gain the advantages of fluorescent lighting for High Bay installations, and for Outdoor illumination.

VHO lamps cost less to buy—less to use, and maintain greater brightness throughout life than other types of very high intensity fluorescents.

These facts are presented in the interest of demonstrating how better lighting is possible at a lower cost . . . how it contributes to increased production and working efficiency, and supports the many factors that reduce operating costs to improve profits.

We believe this concrete evidence of Sylvania's superiority in fluorescent lighting deserves the serious consideration of every executive or purchasing authority.

If you are planning new lighting, or are about to buy fluorescent lamps for your present system, let us demonstrate why you cannot afford to buy anything but Sylvania Fluorescent Lamps. Call or write us today.

Signed, Frank J. Healy

F. J. HEALY, President

SYLVANIA Lighting Products

A Division of SYLVANIA ELECTRIC PRODUCTS INC.

In Canada: Sylvania Electric (Canada) Ltd., Shell Tower Building, Montreal

Dept. 8L-7605, 60 Boston Street, Salem, Massachusetts

Alumoweld Wire Ready for Market

- Alumoweld conductor developed for use on transmission and distribution lines
- "Heat and pressure" process adds aluminum to a steel rod; bimetallic rod drawn into wire
- Conductor is composed of 25% aluminum by area

Alumoweld wire, a new aluminum covered steel conductor for use on transmission and distribution lines is now ready for market, according to William W. Ege, vice president of Copperweld Steel Co's Wire and Cable Div, Pittsburgh, Pa.

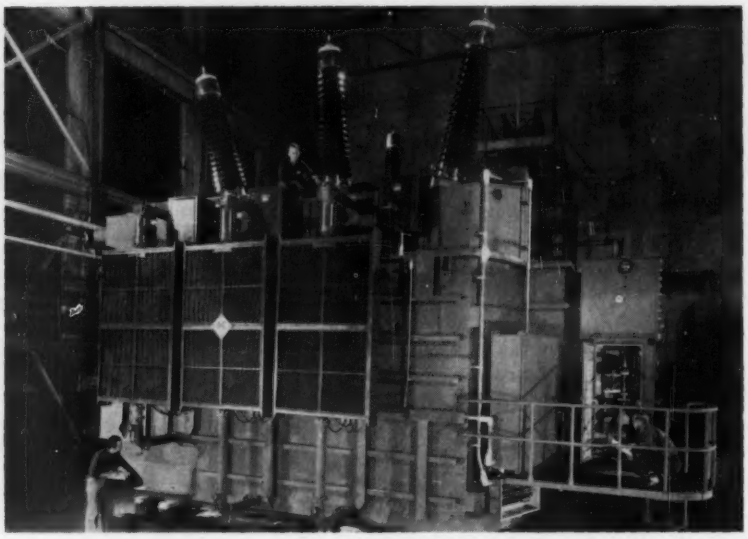
The company states it has successfully applied a heavy cladding of aluminum to a steel rod by a controlled weld process. The new conductor composed of 25% of aluminum by area has been developed by the company jointly with Battelle Memorial Institute in Columbus, Ohio. A pilot plant is now in limited production of Alumoweld rods which are being drawn into wire at Copperweld's Glassport, Pa. plant.

The process is described as a "heat and pressure" procedure. It differs from the process used to make Copperweld wire in which copper is welded to the steel while it is still in a heavy billet form. In the Alumoweld process, the aluminum is added to a steel rod and the bimetallic rod is then drawn into wire.

Among the major problems of development was applying a soft, relatively low melting-point metal onto hard steel while avoiding the intermetallic compound. In previous attempts to produce an aluminum wire with a steel core this had resulted in a brittle bond. Ege said "Alumoweld retains its firm bond, one-metal quality even when drawn into a very fine wire, and has the advantages of better corrosion resistance, better conductivity, lighter weight and high strength."

Ege also said, "We expect Alumoweld to find a major market in overhead ground wires and ACSR transmission conductors. Alumoweld cores can be introduced into ACSR conductors without appreciably increasing the price."

Noting that Alumoweld will augment Copperweld wire he said, "Essentially Alumoweld will find a market where reinforced electrical grade aluminum is desirable. In a great majority of cases there are two completely separate markets determined by such factors as conductivity, strength and weight."



A-C to Ship Its Largest Transformer

Largest power transformer in physical size built to date by Allis-Chalmers Mfg Co will soon be rolling east from the company's West Allis, Wis. works. Weighing 625,000 lb, it's over-all dimensions are: 25 ft high by 38 ft long and just under 18 ft wide.

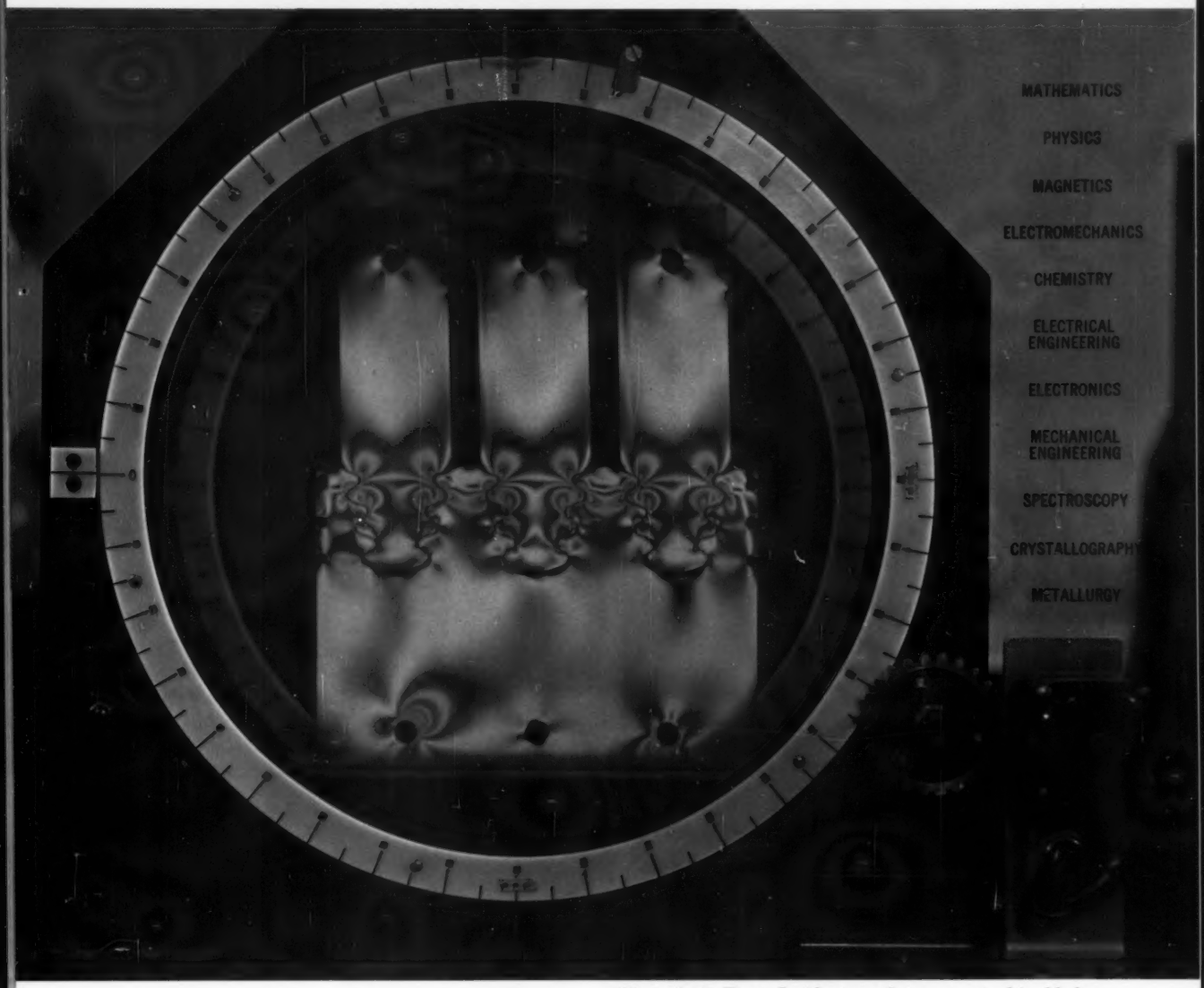
Purchaser of the 200,000-kva, 3-phase, 230-115-kv autotransformer is the Jersey Central Power & Light Co, Denville, N. J. Shipping destination is Whippany, N. J. The transformer will serve as a system tie-in between Jersey Central Power & Light Co and Public Service Electric & Gas Co of Newark, N. J.

Equipped with a load tap changer, the transformer voltage can be varied 10% above or below the rating while energized. It has a 13.2-kv tertiary winding and is forced oil cooled. The transformer is undergoing tests on the impulse test floor of the West Allis plant. It is being subjected to chopped wave voltages of 1035-kv and 900-kv full waves to demonstrate its ability to withstand in-service surge voltages such as might be produced by lightning

McGraw-Edison Sees 1958 as 'Slightly Better'

Results for the year 1958 will be "slightly better" than for 1957, stated Raymond H. Giesecke, treasurer of McGraw-Edison Co. March

(*Continued on page* 91)



Photoelastic Test—Inside story of stresses on turbine blades

The entire industry benefits from Westinghouse plowback of earnings

RESEARCH CREATES BREAKTHROUGHS

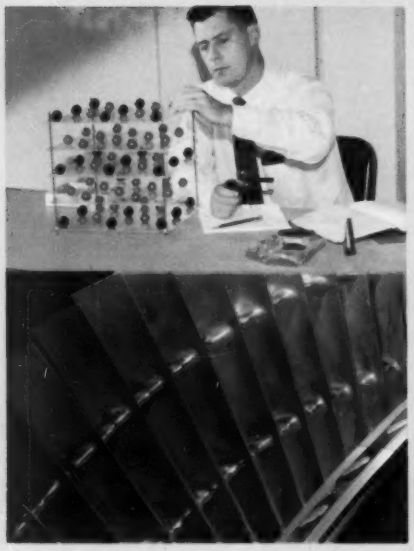
TO NEW KNOWLEDGE, BETTER PRODUCTS

Fantastic load growth is projected for the next 10 years, 20 years, 30 years. The nation's electric utilities will meet it. What are the problems facing the industry? Bringing high voltage close to load, controlled dispatching; in generation—temperature, pressure, vibration, approach to theoretical limits of existing equipment, and a host of others. Out of this maze of interrelated problems, Westinghouse is bringing new products, new systems, new ideas to meet the many future needs of the electric utility. Westinghouse considers this program its obligation to the industry . . . an obligation fulfilled only by a broad policy of reinvestment of earnings into research and development.

New Westinghouse
Research Laboratories

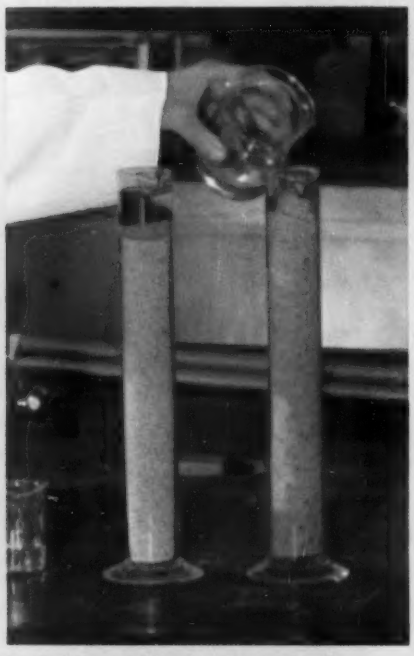
YOU CAN BE SURE...IF IT'S Westinghouse

1. From 19 years' research . . . Thermalastic coil insulation, most stubborn insulation known



2. From a basic knowledge of metals and vibration . . . research with rifle accuracy

4. Electro-negative gas sponges up arcs



3. Making small molecules out of large ones cuts dry-type distribution transformer size up to 50%

6. At Materials Engineering, sureness is designed in

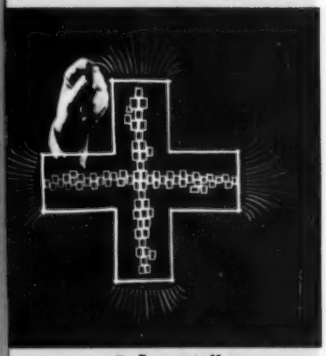
HERE IN THE WESTINGHOUSE RESEARCH LABORATORIES

1958 was years ago

PLOWBACK OF EARNINGS PRODUCES RADICALLY NEW METALS, INSULATION, PROCESSES

Only one development in five from Westinghouse research is the result of a single science. Not only teams of scientists, but teams of sciences are today discovering new knowledge, channeling it toward practical applications of tomorrow.

Westinghouse fundamental research is a panoramic approach to solving the problems of the electric utility industry and to achieving the long-term objectives that underlie them.



5. In metallurgy . . . magnetism turns a corner

7. New metal alloys from formula to pilot-scale production

1. FROM 19 YEAR'S RESEARCH . . . THERMALASTIC COIL INSULATION, THE STUBBORNEST INSULATION KNOWN

What is it? An overlapping barrier of large mica splittings locked into a memory-type resin bond. It's thermally stable. Chemically inert. Rejects moisture. Won't embrittle. Stays elastic. Hugs the copper to which it is applied. Its reliability is proved by 40 million kva in service—on large motors and generators.

2. FROM A BASIC KNOWLEDGE OF METALS AND VIBRATION . . . RESEARCH WITH RIFLE ACCURACY

Problem—higher and higher pressures and temperatures, steam flowing through turbine blade paths at greater speeds. At the research center, mathematicians determine stresses; physicists make models of molecular structure of an alloy, recently created a new alloy, Nivco, testing at 100,000-psi tensile strength at 1200°F. This means that from Nivco will come more efficient turbines.

3. MAKING SMALL MOLECULES OUT OF LARGE ONES CUTS DRY-TYPE TRANSFORMER SIZE UP TO 50%

Remarkable solventless silicones, industry's newest high-temperature, high-voltage impregnants, lead a double life. Silicones in viscous form, with giant molecules, barely flow; their function is to stay put, hold mica flakes together. Fluid (right-hand flask) silicones' small molecules penetrate thoroughly and then form void-free solid insulation to stand heat better. Result—product size cut drastically.

4. ELECTRO-NEGATIVE GAS SPONGES UP ARCS

Presently applied on high-voltage switches, sulfur-hexafluoride is one of the most effective arc-interrupting agents known. In the test shown here, a 10-kv arc in the horizontal tube of air is instantly quenched when injected with SF_6 gas.

5. IN METALLURGY . . . MAGNETISM TURNS A CORNER

Cubex®, a newly developed alloy, breaks through a long-standing magnetic barrier, promises significantly improved performance of motors, transformers and other apparatus. The metal crystals are aligned in ice-cube fashion so that magnetism readily flows in four directions instead of two, turns corners with less resistance.

6. AT MATERIALS ENGINEERING, SURENESS IS DESIGNED IN

In the Materials Engineering Departments, research discoveries are transformed into practical engineering form. Projects are then turned over to operating divisions for application. An example is the procedure developed by Materials Engineering for ultrasonic testing of rotors and spindles. This procedure has contributed heavily to the unexcelled record for dependability of Westinghouse turbine generators.

7. NEW METAL ALLOYS FROM FORMULA TO PILOT-SCALE PRODUCTION

Bridging the gap between initial development and mass production is Blairsville . . . completely equipped for metals analysis and pilot-scale production. Nivco, alloys for atomic energy equipment and other metals used throughout the company are being developed here.

YOU CAN BE SURE...IF IT'S

Westinghouse

Curiosity in depth . . .

FROM 6000 ENGINEERS AND SCIENTISTS AND 200 LABORATORIES COME NEW KNOWLEDGE, NEW PRODUCTS, NEW SYSTEMS

Laboratories in every operating division of the company are continually engaged in both long- and short-range product development and improvement programs. Many of these projects originate at the Research Laboratories, are further developed, designed and tested at the divisions. Most problems directly involved with product improvement are solved with the division's own facilities.

1. $7,500,000 WORTH OF ABSOLUTE QUIET

This is one of the world's largest anechoic half-spaces where complete sound measurements can be made on transformers far larger than any presently in service. With the help of this multimillion-dollar facility, transformers of the future will be smaller, lighter, quieter, more economical.

2. PUTTING THE PRESSURE ON GAS TURBINES AND COMPRESSORS

The variable density wind tunnel helps create vital design advances. It tests model blade profiles and paths under all operating pressure conditions. Highly loaded gas turbines can also be investigated. The most promising designs are selected for full-scale testing in high-power rigs.

3. $6,000,000 INVESTMENT IN ADVANCED TURBINE DEVELOPMENT

Through the work done at the new development laboratory, the Steam Division is now building the world's most efficient and one of the largest turbine generators, for 5000 psi 1200°F, the most advanced steam conditions now planned. Development work at the lab ranges from bearings to complete blade paths.

4. ONE TURBINE DEVELOPMENT CAN SAVE A UTILITY UP TO $450,000

In a 200,000-kw generating plant, 1% improvement in heat rate can, depending on fuel cost, justify a utility capital investment of up to $450,000. Photoelastic test of a new blade root shows stress concentration under simulated operating conditions. Tests like this lead to an array of turbine developments, providing increases in efficiency and savings to utilities.

5. FIVE MINUTES TO A BETTER TRANSFORMER

Power transformer design time has been drastically reduced by this IBM 705 computer, freeing engineering time for the creative development of tomorrow's transformers.

6. SEVEN VEILS AGAINST WEATHER

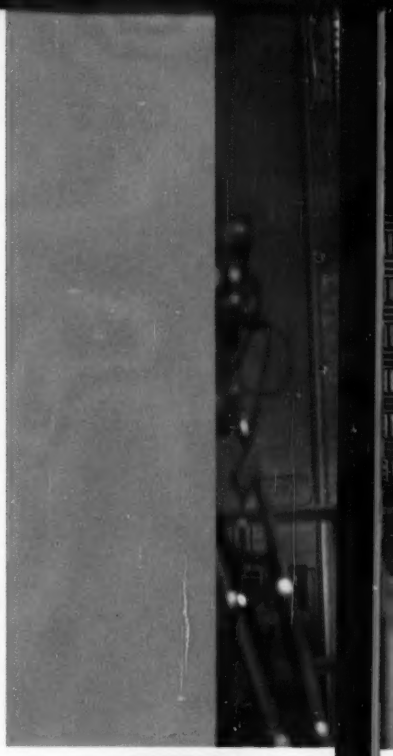
A half-million-dollar investment has created seven modern laboratory facilities for development of watthour meters at the new Raleigh plant—chemical, metallurgical, environmental, life test, mechanical, analysis and electrical development. From the chemical lab, for instance, come new organic and inorganic finishes for protection against everything from salt spray to ultraviolet light.

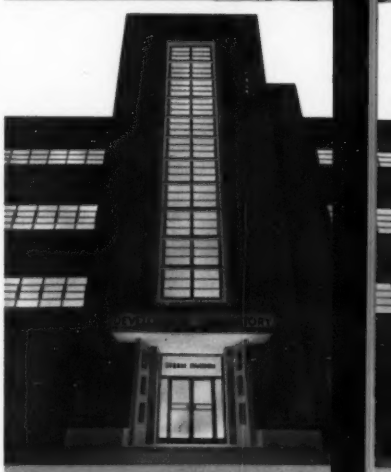
7. 5,200,000-VOLT SKYSCRAPER

Used in the verification and testing of new insulation systems for transformers, this surge generator is constructed from 104 100-kv capacitors in layers to a height of 52 feet. This unique design tool is part of the ultramodern transformer research and commercial testing laboratory.

8. THREE BILLION VOLT-AMPERES OF SURENESS

With capability to duplicate virtually every known system characteristic under controlled conditions, the High Power Laboratory has proved to be the industry's most valuable single design tool. For over 32 years, the capability and availability of this facility have fostered designs which have saved utilities millions of dollars.





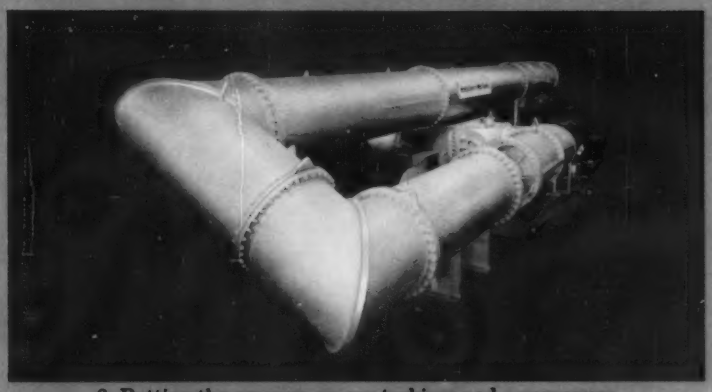
3. $6,000,000 investment in advanced turbine development

6. Seven veils against the weather

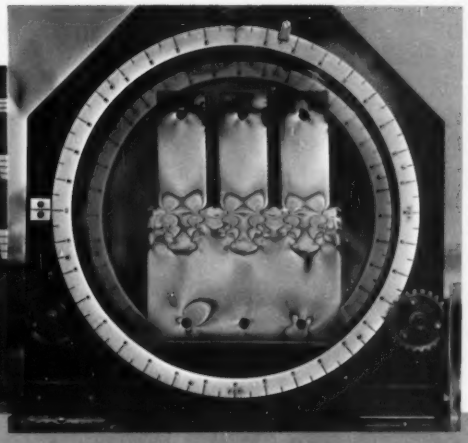
YOU CAN BE SURE...IF IT'S

Westinghouse

1. $7,500,000 worth of absolute quiet

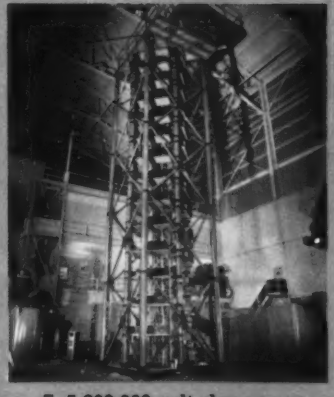


2. Putting the pressure on gas turbines and compressors



4. One turbine development can save a utility up to $450,000

5. Five minutes to a better transformer

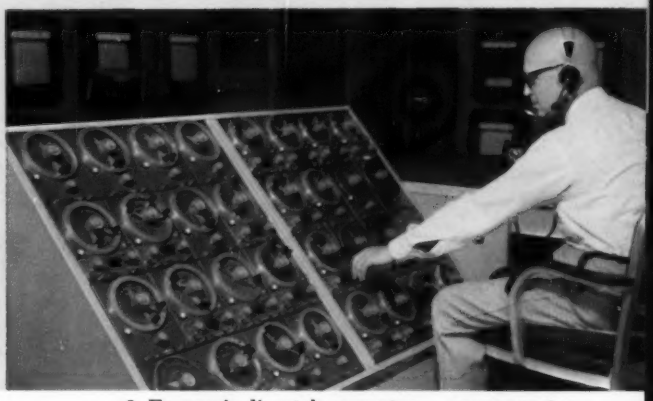


7. 5,200,000-volt skyscraper

8. Three billion volt-amperes of sureness

1. Out of snow and rocks . . . a laboratory

2. How to climb a mountain in total dark



3. Economic dispatch computer . . . nerve center of West Penn Electric interconnected system

Plowback creates breakthroughs

TO HELP UTILITIES PLAN FUTURE SYSTEM COORDINATION AND ECONOMICS

A broad area of communications at Westinghouse, helping the industry plan, evaluate, test and apply new ideas and systems, is the Electric Utility Engineering Department. Within the department's engineering groups, for example, sponsor engineers, assigned to utilities in specific areas of the country, review broad application and engineering problems and direct studies for their solution. Other electric utility engineering groups are assigned to specialized problems and long-range studies advancing the fields of generation, transmission and distribution. Service engineers and consulting and application engineers provide a strong right arm in the field. These groups apply both a broad knowledge of the industry and specialized experience to your problems of today and to your objectives for the future.

1. OUT OF SNOW AND ROCKS . . . A LABORATORY

Broadening the test program that began with A.G.&E. at Tidd Station, an extra-high-voltage test transmission line has been built at 10,000 feet elevation in the Rockies in cooperation with Public Service Company of Colorado. For the specific purpose of measuring corona and radio influence especially under violent extremes of weather, voltages ranging from 173 to 500 kv are being investigated. Knowledge gained here will shorten the road

5. A five-state power network in one room

4. How lightning arresters keep ahead of lightning

to economical transmission of large blocks of power at super voltages, will help assure the equipment to handle it.

2. HOW TO CLIMB A MOUNTAIN IN TOTAL DARK

Automex—or automatic experimenter—could solve this kind of problem, if turned loose on it. At Westinghouse, its job is to reach a control objective when complete knowledge is not available. A general purpose automatic control, this machine studies problems, profits from its own mistakes. As part of an automation system, Automex may one day run an entire chemical plant or paper mill.

3. ECONOMIC DISPATCH COMPUTER . . . NERVE CENTER OF WEST PENN ELECTRIC INTERCONNECTED SYSTEM

Trends toward integration of whole power systems and interchange between systems put a premium on precision and speed of dispatching. The Westinghouse computer determines the most economical output of all generating stations automatically, specifies correct spread of load, greatly simplifies dispatchers' problems.

4. HOW LIGHTNING ARRESTERS KEEP AHEAD OF LIGHTNING

This SVS station arrester, even after 1200 lightning surge tests at the Switchgear Division, shows no change in performance characteristics. Improved Autovalve® arrester blocks, rigid production quality control, continuous high-voltage surge testing have produced designs reducing arrester discharge voltage by 20% in recent years.

5. A FIVE-STATE POWER NETWORK IN ONE ROOM

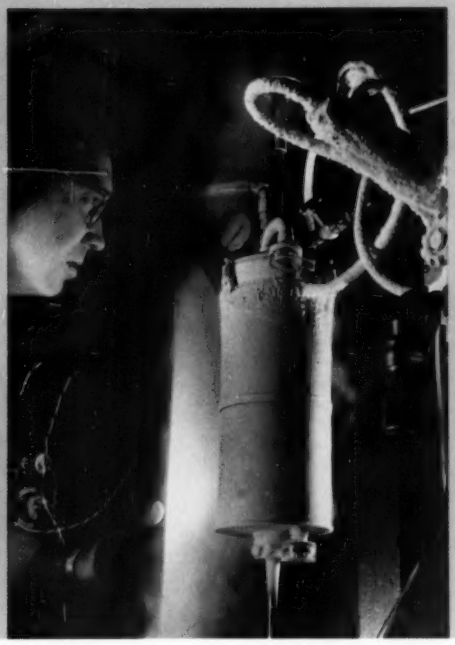
Here is the world's largest a-c network calculator, with 36 generating stations, 580 circuits, capable of simulating the largest power systems. System planning in the fields of voltage regulation, stability studies, short circuit analysis and many others has been an enormous timesaver to hundreds of utility engineers who have used this facility and who are welcome to do so.

YOU CAN BE SURE...IF IT'S Westinghouse

1. From Westinghouse will come the next "first" in atomic power

3. Super-pure . . . they count the molecules

2. Perpetual power at 450°F below zero



MADE POSSIBLE THROUGH WESTINGHOUSE REINVESTMENT OF EARNINGS . . .

Ideas in research discipline the unknown

Research at Westinghouse is a vast quest for new knowledge. The electric utility industry has in the past benefited heavily from Westinghouse research. The industry is continuing to benefit—in money saved, in hours and years saved, in goals achieved—and will into the future. This is because Westinghouse is continuing to pour energy, imagination, talent, money into extensive programs of research.

1. FROM WESTINGHOUSE WILL COME THE NEXT "FIRST" IN ATOMIC POWER

The Westinghouse Testing Reactor will generate answers, not line kilowatts. This facility, under actual conditions of irradiation, temperature and pressure, will evaluate fuel elements and reactor equipment. Knowledge of nuclear technology gained here will enable utilities to produce commercial atomic power sooner and at lower cost.

2. PERPETUAL POWER AT 450°F BELOW ZERO

At temperatures such as this, many metals lose all measurable resistance, become perfect diamagnets, circulate induced electric current in a closed system—apparently forever. What will come from this superconductor development? Can electric power be stored? Will current in the future be transmitted over tiny wires instead of cable?

3. SUPER-PURE . . . THEY COUNT THE MOLECULES

The process is known as cage-zone refining, achieving metal pure to a few parts in a billion. Material being melted acts as its own crucible. The bar is melted progressively end to end, drawing impurities in one direction. Semiconductors now. In the future, a procession of useful developments will come from this basic work at Westinghouse. CP-1047

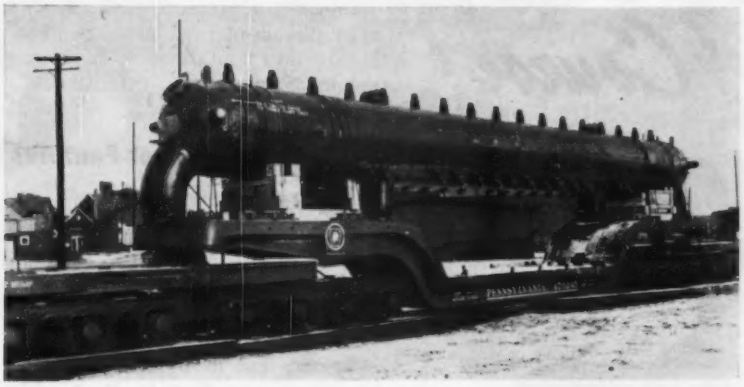
YOU CAN BE SURE...IF IT'S Westinghouse

McGraw-Edison

(*Continued from page* 82)

sales volume of the diversified company was "somewhat better" than in January and February, he continued, and the improved trend apparently is continuing for April. Results for the first quarter, as anticipated, were below those of a year ago.

McGraw-Edison is in sound financial condition and is operating without short term borrowings, the company treasurer stated. Inventories at the beginning of the year were $5 million lower than a year ago, indicating that most of the firm's divisions will probably operate on a relatively higher level during 1958, he estimated.



B&W Starts Shipments to Memphis

A 403,500-lb boiler drum is shown prepared for a 780-mile rail journey from Babcock & Wilcox Co's Barberton (Ohio) works to the Thomas H. Allen Electric Generating Station in Memphis, Tenn. This 78-ft long drum will be part of one of three identical boilers B & W is furnishing. Total cost of all three boilers is reported to be more than $24.5 million.

The boilers are designed for steam conditions of 2475 psi, 1053F at superheater outlet, and 1053F reheat; feed water temperature being 568F. The three units will supply steam to produce more than 750 mw per hour. Each will be fired by 7 Cyclone furnaces and be among the largest and highest pressure natural circulation types constructed to date, according to the manufacturer.

Shipment of the drum was made on a Pennsylvania Railroad depressed flatcar 121.75 ft long with a 503,600-lb load limit. Over-all height was 18.75 ft above the rails, an inch less than the route's maximum clearance. Maximum speed of the car was limited to 30 mph, and an empty car was placed at each end of the flatcar to avoid weight concentration.

Alcoa Moves to Open New Aluminum Market

Aluminum Company of America, Pittsburgh, Pa., has made a move to open a major new market for aluminum in the electrical field with the purchase of the transformer division of Automation Instruments Inc, Boulder, Colo. All technical data and research and development equipment of the company were included in the purchase. Alcoa's market objective is the application of aluminum foil and sheet strip windings for transformers and miscellaneous electrical equipment.

The newly acquired facility will be moved to Alcoa Research Laboratories, New Kensington, Pa.

(*Continued on page* 92)

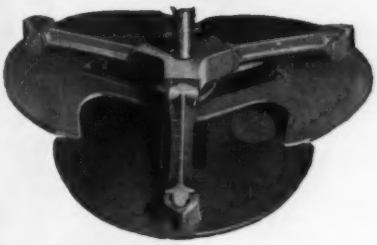
The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power

QUICKLY Installed

TOUGH For long life

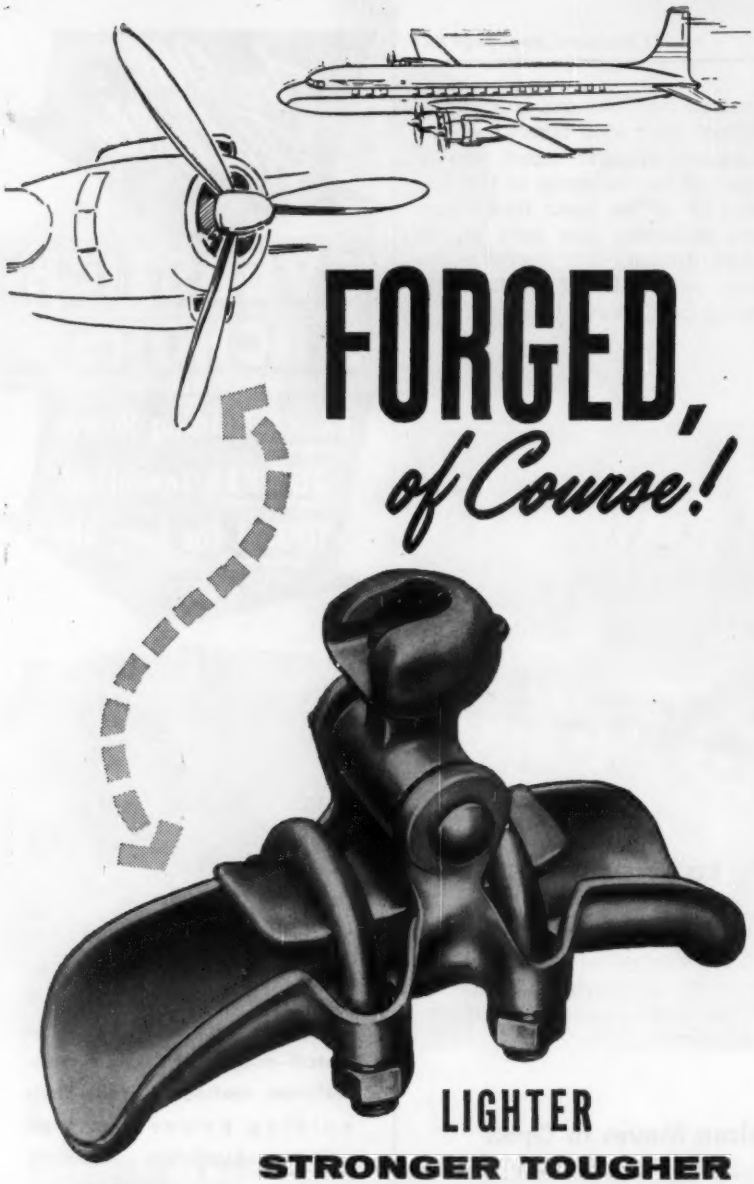


● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE EVERSTICK FEATURE
Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO

FAIRFIELD, IOWA



ALCO Market

(*Continued from page* 91)

There, further research on aluminum strip windings will be done, and to aid in this Irving O. Schaefer, chief research engineer for Automation Instruments' transformer division, will join the Alcoa research staff.

Up to now, attempts to apply aluminum in the field of electrical windings have been confined largely to mere substitution for other materials, Alcoa feels that to realize the inherent advantages of their metal, the design of such windings should take into consideration all of aluminum's natural characteristics.

New Transformer Features Inner-Cooled Design

The development of an "inner-cooled" transformer has been announced by Westinghouse Electric Corp. Using the new principle, transformers can be built smaller, lighter, and in significantly higher ratings, according to R. N. McCollom, manager of the company's power transformer dept, Sharon, Pa. "With the conventional methods of design, we have already built and shipped three-phase transformers rated at 380 mva. With the new 'inner-cooled' design, we foresee ratings up to about 600 mva," Mr. McCollom said.

In the new design, the oil is circulated between the strands of parallel conductors that are at the same potential, eliminating oil ducts between coils and windings. This allows the use of materials having higher insulation strength than oil where voltage stresses occur. In this manner, smaller, lighter, and higher capacity units can be built that have the same design margins as conventional construction, it is reported.

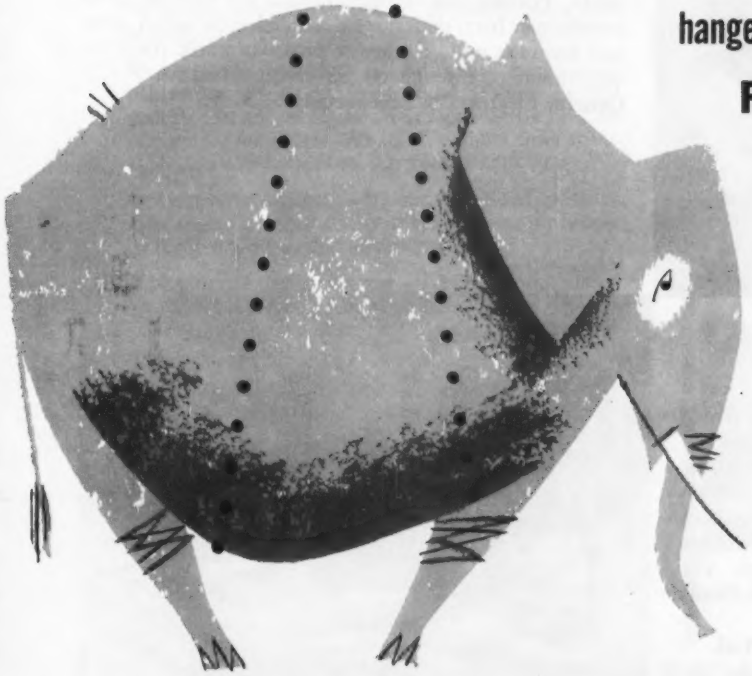
The first commercial unit of the new design is being manufactured for the New York State Electric & Gas Corp. The 50-mva, three-phase, 115-kv transformer is scheduled for delivery in May, 1958.

•

ASA: American Standards Association, New York, has issued American Standard Practice for Storage of Microfilm: PH 5.4-1957.

Unretouched photograph of shot-blasted, unpainted tank.

to keep the transformer on the pole . . .



hanger brackets of Pennsylvania **POLE STAR** distribution transformers are hand-welded completely around the bracket flange.

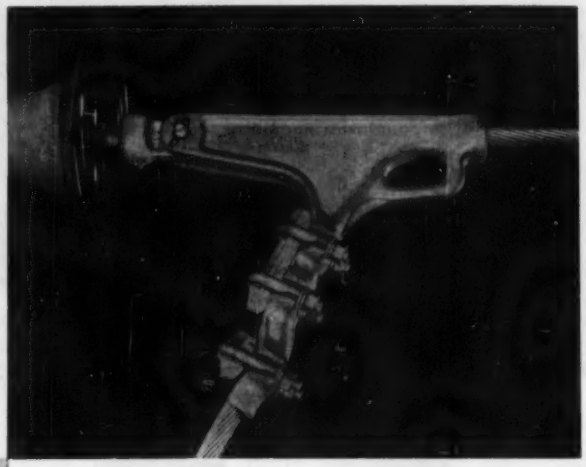
No crevices are left that might remain unpainted and where rust-producing moisture can collect.

McGRAW EDISON

PENNSYLVANIA TRANSFORMER DIVISION
McGraw-Edison Company • Canonsburg, Pa.

POLE STAR

Large Dead-End Clamp . . .



. . . has maximum cable clamping range of 0.86 in. Designated PG-86, this aluminum distribution quadrant dead end clamp accommodates ranges of No. 4/0, 6/1 ACSR through 477, 26/7 or 250 Mcm through 566.5 in 37 strand aluminum.

Light weight construction protects conductor against damaging vibrations. Non-ferrous keepers are additional protection and obviate ribbon or tape. Clamp can be supplied with socket or clevis fitting. Nose extension facilitates hot line maintenance of insulator strings by allowing span end of clamp to seat in line strain carriers.

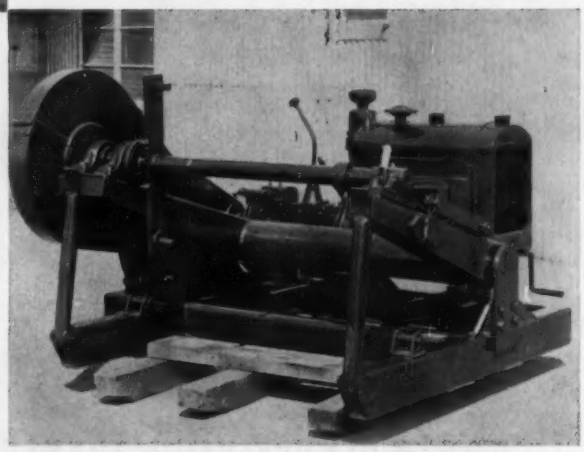
Anderson Electric Corp, Birmingham 1, Ala.

Burial Enclosure . . .

. . . accommodates pole-type transformers in ratings up to 167 kva in 15 kv class. Unit consists of low, dome-shaped steel cover hinged to section of standard 48-in. corrugated culvert pipe. Cap projects only 33 in. above grade. Primary and secondary leads are brought up to transformer from underneath. Baffled vents let air enter and leave the unit. Enclosure provides ample room for installation of disconnects on casing brackets.

General Electric Co, Schenectady 5, N. Y.

Cable Puller . . .



. . . for light distribution circuits has maximum pull of 1,000 lb at speeds up to 3 mph. Capable of loading and unloading reels with 34-in. width and 48-in. diam., the self-powered unit weighs 5,000 lb. and has 15 hp gasoline engine. It may be mounted on flat-bed truck or trailer. Backstop permits gear shifting without danger of tensioned cable running back. The 5400 cable puller raises or lowers reels hydraulically in less than 60 sec.

Petersen Engineering Co, Inc, Santa Clara, Cal.

(*More New Equipment on page* 96)

ALLIS-CHALMERS
low voltage
switchgear

Here's

Proven Accuracy

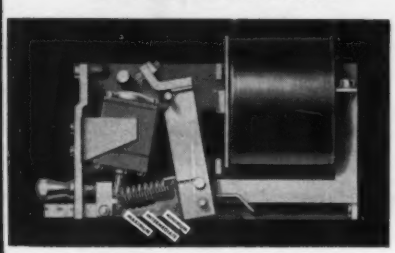
3 independent elements available in series trip device

This time-proven feature of Allis-Chalmers low voltage switchgear provides:

- **Accurate settings** — Adjusting knobs with calibration scales on front of trip device permit operator to adjust elements independently and set pickup for long time (80-160%), short time (500-1000%), and instantaneous (500-1500%).
- **Accurate action** — Silicone oil-filled, positive displacement time-delay device is completely calibrated and sealed under vacuum.
- **Accurate adjustment** — Minimum, maximum and intermediate time-delay band settings are field adjustable for each pickup value for fine selectivity.
- **Accurate indication** — Overcurrent trip flag to indicate phase which caused tripping of breaker is available.

Each trip element has its own armature and each armature acts directly on trip block. Accurate trip device is only one feature of Allis-Chalmers low voltage switchgear. For complete details, call an A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Operator inserting circuit breaker using positive-position pantograph. Note trip device accessibility, dead-front breaker, and drawout interlock.



Cutaway shows arrangement of components in Allis-Chalmers direct-acting series trip device. Note calibration scale below adjusting knobs and time band setting on armature extension.

A-5353

ALLIS-CHALMERS

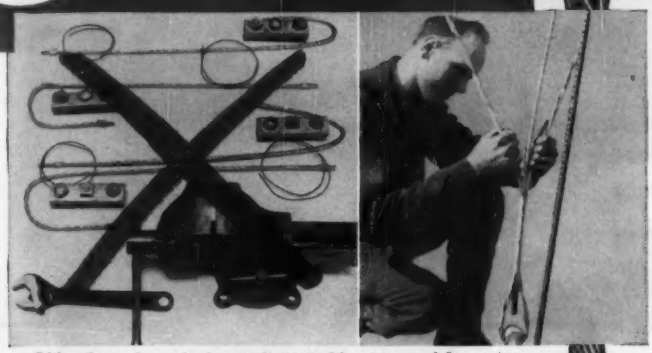
TO 49% $AVINGS

on materials alone

with

Fine Fanner Superformed FANNGRIPS

FOR DEAD-ENDING GUY STRANDS



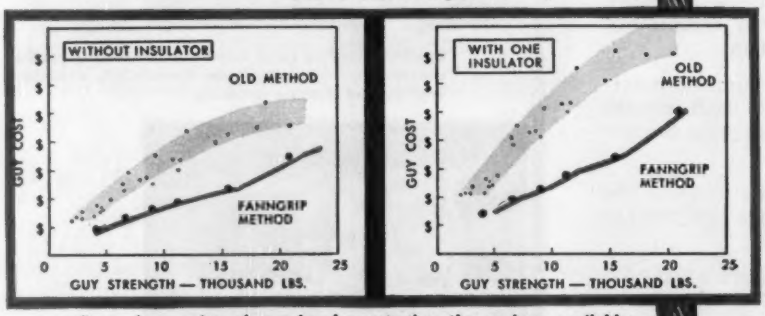
Old style costly methods are eliminated by the use of Fanngrips.

Now . . . costs compiled from typical guying methods using Fanner Fanngrips in comparison to other types of gripping devices show savings up to 49% *in materials alone* . . . in addition to the tremendous savings in time and labor!

Now . . . when savings are so important . . . here is more reason than ever to take advantage of the many Fanngrip features offered by no other type of gripping device:

- Provide maximum strand strengths.
- Eliminate laborious field fabrication.
- Self-clamping, permanently tight.
- Heavy coatings protect from corrosion.
- Do not damage guy strand surfaces.
- Dangerous and wasteful strand ends eliminated.
- Available in "B" or "C" coated galvanized steel, or copperweld.

Ask for cost-saving data today!



Two of a series of graphs demonstrating the savings available through Fanngrips over ordinary gripping methods.

Licensed for use under patent Nos. 2,275,019 and 2,587,521

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Division of Textron, Inc.

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Fine Fanner Superformed Products

AGENTS and DISTRIBUTORS IN PRINCIPAL CITIES

ARMOR RODS · LINEGUARDS · TAP ARMOR · PATCH RODS · FANNGRIPS

PLASTIC FANNGUARDS · PLASTIC INSULATING TUBINGS AND MOLDINGS

Potential Transformers . . .

. . . rated 8.7 and 15 kv are butyl molded. Butyl serves as combined bushing, base, and insulation. Both indoor and outdoor models include 0.3 ASA accuracy at burdens W, X, Y, and Z. Full-wave impulse levels are 75 kv for 8.7-kv model, 110 kv for 15-kv model. Thermal rating is 1,000 va at 30C. ambient. Ratios are 60-, 70-, 100-, and 120-1 for the 15-kv rating; 35-, 40-, and 60-1 for the 8.7-kv rating. The outdoor 8.7-kv rating is also available with 20-1 ratio.

General Electric Co, Schenectady 5, N. Y.

Truck Ladder . . .

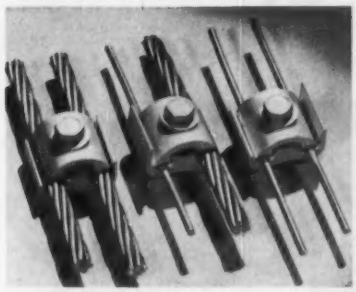
. . . has fiber glass upper section which provides good insulating values, lightness, stability, and strength. Platform heights of hydraulic-electric unit are from 28 ft on up. Electric power is standard but power take-off or independent gasoline engine power options are available. Standard controls are at the top. Ladder fits neatly on any standard truck body and stows low and short.

Truck Equipment Co, 3961 Walnut St, Denver, Colo.

Exit Gas Analyzer . . .

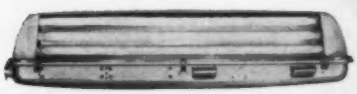
. . . samples, cools, washes, and analyzes gases up to 3200 F for oxygen and combustible content. Completely enclosed units may be used indoors or outdoors. Transfer

valves may be added if multiple point sampling is required. Line includes water-cooled, water spray, and dry types. Product Specification E65-6.
Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio



Extruded Clamps . . .

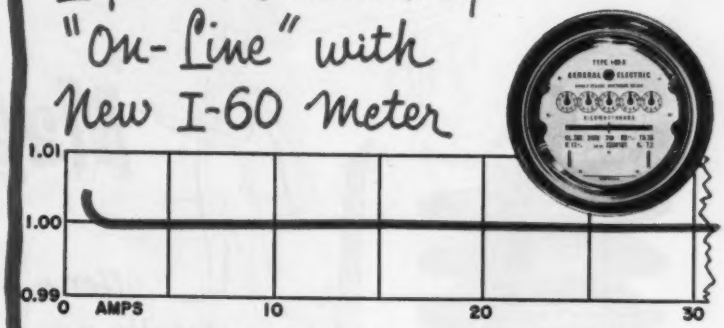
. . . cover wide range of conductor sizes. These Series 390 to 490 clamps are made of high strength, high conductivity alloy. Clamp bases are tapped to eliminate nuts and clamp can be installed without being disassembled. Lip on tap groove prevents top from turning during tightening. Groove surfaces are specially cleaned and protected by grease film.
Aluminum Co of America, 738 Alcoa Bldg, Pittsburgh 19, Pa.



Fluorescent Luminaire . . .

. . . for street and highway use has 55,800 lumen output. Unit uses six 6-ft Power-Groove lamps. Temperature is controlled by specially designed cooling system with sealed reflector-heat exchanger that prevents bugs, dirt, and moisture from entering luminaire. Intake and captive-air fans are driven by sealed, self-lubricating shaded pole motor. Installation is simplified by prewired terminal board that requires only two connections. Form 606 luminaire has high degree of stability at wind velocities in excess of 100 mph.
General Electric Co, Schenectady 5, N. Y.

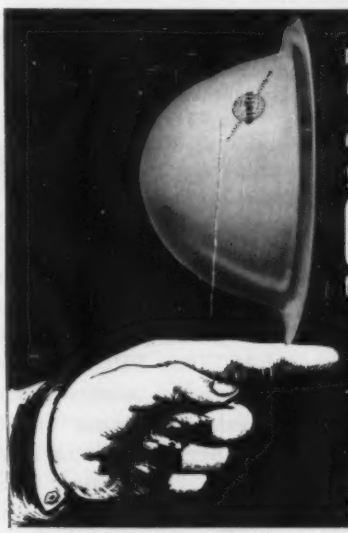
Light-load Accuracy "On-Line" with New I-60 Meter



General Electric's new Class 200 I-60 meter offers truly outstanding accuracy at light loads... equal to or better than any Class 100 meter. Your G-E salesman will show you why.

(628-14)

GENERAL ELECTRIC



dielectric resistance breakdown over
25,000 VOLTS
yet weighs
ONLY 12½ OZ.
for all day, every-day comfort

NEW GENTEX ALL-PLASTIC SAFETY HAT
for high-voltage protection.

more protection with less weight through GENTEX research-for-safety

Far exceeds all Government standards and E.E.I. specifications for rugged, safe protection — made of GENTEXITE plastic. No holes, bolts, rivets or metal in crown, brim or sling to create electric shock hazard.
MEN LIKE ITS COMFORT • THEY WEAR IT. Permanent non-wrinkle headband. Instant snap-in, fingertip-adjusting washable head-cradle sling. Handsomely styled in green, gray, white, yellow, blue.

YOU CAN BET YOUR LIFE ON A GENTEX

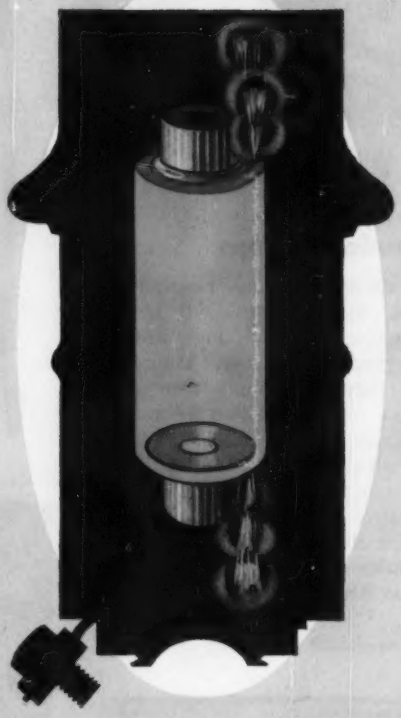
Send today for a test hat and full specifications
Ask about our lightweight, washable winter liners.
WORLD'S FOREMOST MANUFACTURER OF HELMETS FOR THE MILITARY
GENERAL TEXTILE MILLS, INC., Dept. W, 450 Seventh Ave., N. Y. 1, N. Y.

AUTOGAP ARRESTERS *with the exclusive*

"Magic Cylinder"

offer a totally new conception in

DURABILITY



Heart of the Autogap arrester is the "Magic Cylinder." The symmetrical arrangement affords the surge current a multiplicity of equally attractive sparkover paths. Here in the highly restricted discharge path the surge quickly forms non-conductive gases, and deionizes the path with the speed of lightning. More than 99% of service operations are without power-follow current.

Autogap arresters have been providing trouble-free protection on distribution systems since first introduced in 1940 . . . without measurable wear . . . without change of performance characteristics . . . WITH LASTING PROTECTION.

Here is durability without equal . . . durability combined with proper sparkover—durability combined with negligible discharge voltage even with the highest values of lightning discharge current . . . durability proven by field service over an eighteen year period . . . durability on distribution systems of highest capacity . . . durability in areas of most severe lightning exposure.

Your Hubbard representative will be glad to supply you with full information. Call him today—or write for literature.

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CHICAGO 50, ILLINOIS • OAKLAND 8, CALIFORNIA • PLANO, TEXAS.

Report on
Stockholder Relations

How Utilities Inform the Investor

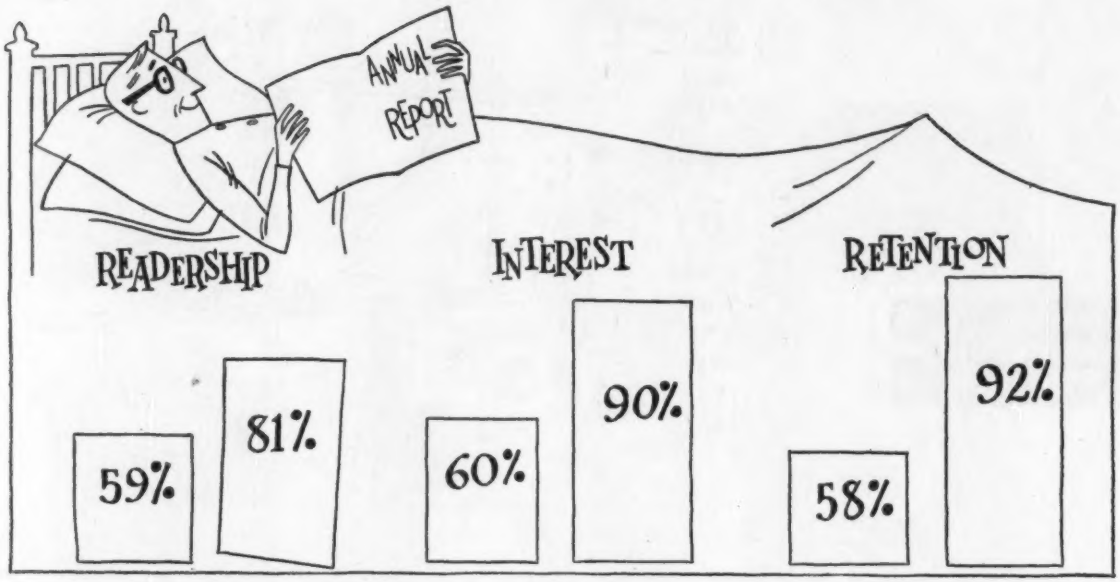
A corporation must render an audited financial statement to its stockholders once a year. In today's competitive money market, however, it's a rare stockholder who receives only this legal minimum of information about the company in which he has invested his funds. As he decides where to place his money, the investor today has access to a wealth of data: The annual report has grown from a few columns of figures to an illustrated magazine; stockholders meetings are more widely attended and are covered in the press; detailed supplementary financial reports have been designed especially for the security analyst, whose advice stands behind most investor selections of which stock to buy.

Most utilities put considerable effort into stockholder relations and financial publicity. The scope of this effort, and the direction it takes, vary widely from company to company. It's a matter of philosophy. For example, take a look at the different ways two electric utility holding companies view stockholder relations:

• **General Public Utilities believes in brevity, clarity, and prompt reporting** to the stockholder and the security analyst of the information each needs to have. Management asks itself: "What does the stockholder want to know?"—and reports that information without embellishment. GPU relies on performance to assure a good market for its stock. Nothing that smacks of promotion finds its way into the stockholder program. All "extraneous" matter is weeded out.

• **Middle South Utilities feels its responsibility runs deeper.** A complete program of publications, meetings, and service area tours aims at keeping the stockholder and the financial community up to date on the company's operations and spread-

ing widely the story of the company's growth. The stockholder has a right, says MSU, to keep up with what his company is doing, and it is management's responsibility to get the word to him. Spreading the word of the company's growth also strengthens the stock and helps protect the stockholder's investment by making it easier and cheaper to raise money. Because its service area is next door to Tennessee Valley Authority territory, Middle South also keeps its stockholders filled in on the federal power picture.



The annual report has become the showpiece of stockholder relations. Opinion Research Corp recently checked 22 annual reports for readership, interest expressed by the readers, and their retention of the most important information presented. The spread between highest and lowest is charted in the illustration above. According to Opinion Research Corp, presentation makes the difference between an annual report that is read, and one that gets a hurried glance from the stockholder and is then thrown away with yesterday's newspaper.

Here's what a good annual report will be like five years from now, according to Opinion Research Corp:

- **The report is themed.** Cover, summaries, text, and illustrations all reinforce one unifying idea of the company as an investment.
- **The president's letter capsules the report story**—keeps dull statistics to a minimum, interprets recent events and the outlook.
- **Photos, drawings, maps, and charts dramatize the major points.** Teamed with explanatory text, they are never used just to "break up the page."
- **Simple prose tells the story,** and gets it across to maximum number of readers.
- **Management is introduced to the stockholders,** through photographs and brief biographical sketches.

Today's annual reports draw both praise and criticism. Here are some comments from one authority who feels that reports have improved generally: "Annual reports today have gone too far in color and pictures. They sometimes cover up what they are trying to show. As far as I'm concerned, companies can leave out

that split-up dollar (showing where revenue comes from and where it goes) that you find in most of the new crop of reports, and hold down pictures of the president and the board." His recipe for a good report: "Start with a creed—what the company is trying to do. Then a one-page summary of the year's achievements, with a page number referring to the complete data. Have a two-page spread for each big table, and include ten years of comparative operating statistics, balance sheets, and income accounts."

The trend is to more frequent reporting, and more data for security analysts. Although they differ in manner of presentation, General Public Utilities and Middle South Utilities agree on the importance of quarterly reports and of quick reporting of important information at any time to stockholders and to the financial community.

GPU's annual report is not much different from a quarterly report. It has no charts, no photographs, and is so small it can be enclosed with a dividend check. Yet its carefully prepared text and tables tell the story, and in spite of its lack of "glamor"—or perhaps because of it—the report pleases stockholders. GPU also publishes a book of information and trend data designed especially for the security analyst. Here again the yardstick is applied: "What do they want to know?" and that data is included. The company briefly comments on the significance of some of the data presented.

Middle South goes in for more striking presentation, (of prize-winning quality), but believes in fast reporting too. A monthly earnings statement goes out to analysts, investors, and the press. So do quarterly reports and an annual statistical supplement.

Stockholder relations is not all literature. In an effort to get more of the stockholders out to annual meetings, Wisconsin Power & Light Co holds a series of them in its service area. This year fifteen are scheduled. Middle South moved its annual meeting to New Orleans last year to encourage attendance by local stockholders. Total attendance hit 400. This year's meeting will be held at a steam station in Little Rock, and regional meetings are planned for Boston and Philadelphia.

Middle South also meets with investor groups all over the country. Since 1952, company spokesmen have addressed analyst societies and other groups in eleven

U. S. cities plus Toronto and Montreal. Stockbrokers, investors, analysts, and financial writers are invited for tours of the Middle South service area. Today these tours are whirlwind affairs with no fanfare or banquets and with from one to four guests. On one past tour, however, were 35 guests from the West Coast—including the president of the San Francisco Stock Exchange. All were impressed by Middle South's growth, and several financial editors who made the tour wrote bylined articles for their papers about how their "eyes had been opened" to progress in the South.

Financial publicity may be even more important to a smaller company. Twelve Wall Street brokerage houses now make daily bids on Southern Nevada Power Co's stock, where last October there were only seven. Part of this may be attributed to a year-old policy of monthly reporting and other information activities. Hawaiian Electric Co got an improved bond rating shortly after a group of security analysts from the mainland journeyed to the islands for a personal look at the company's service area. One New York analyst summed it up this way: "There are too many good utility stocks already on the market for me to spend much of my time digging for new ones." And if this is true of the analyst, it is certainly true of the average investor.

"There is a direct relationship between what a company tells stockholders and investors and the yield it must offer to sell its stock," said another analyst of utility securities. "The way a company presents its annual report is not anywhere near as important as its business prospects or the earnings it reports, of course, but it has some bearing." And Weston Smith, financial public relations consultant and founder of the Financial World annual report contest, put it in these words: "An annual report cannot say 'Buy Our Stock' or 'Our Shares are a Bargain at Present Prices', but the illustrations and copy can be prepared to influence the minds of the shareholders and motivate them to: 1) Continue to hold the stock; 2) Increase their holdings of the shares; and 3) Talk to friends and associates about buying the stock."

Other Good Examples of Stockholder Relations at Work:

For years **Idaho Power Co** officials have made annual trips to the East Coast. They have called on financial institutions, told the story of what's going on back in Idaho, and answered questions—giving investors and analysts a chance to get their information through person-to-person contact.

Southwestern Public Service Co also sends officials to meet with security dealers and institutions all over the U. S., and has done it for years.

Today most utility presidents welcome the opportunity to address the New York Society of Security Analysts, and more companies publish annual report supplements designed for the analysts' use.

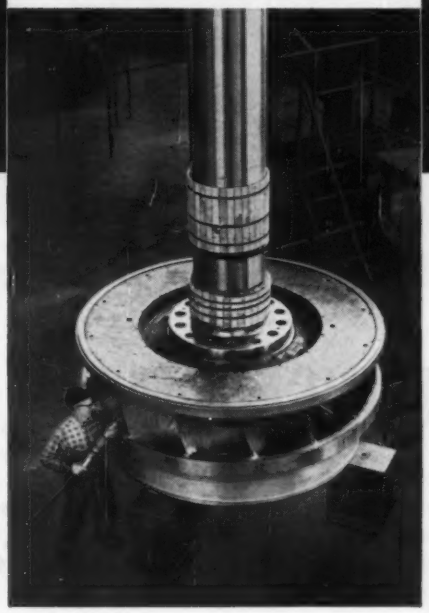
Atlantic City Electric Co regularly sends out news items to help analysts keep up with the power situation in its territory. These take the form of clippings and memos forwarded "For your information, no acknowledgement required." One analyst who receives these items said they had been instrumental in proving that the resort business is more stable than had been supposed.

The Southern Co, Ohio Edison, Florida Power Corp, West Penn Electric Co, as well as **Middle South,** are just a few of the utilities that are helping to build their reputations as good investments through service area trips.

Another B-L-H boost for our bustling Northwest... two 56,000 hp Francis-type turbines for Big Bend

◀ Down shot of partially assembled turbine unit built by B-L-H's Eddystone Division for The California Oregon Power Company's Big Bend Project.

A Francis-type turbine runner for The California Oregon Power Company being machined at Eddystone. ▼



Mighty B-L-H turbines at 28 huge dams in the expanding Pacific Northwest are producing almost 3 million kw every hour they run. Soon to swell the number are two Francis-type turbines which The California Oregon Power Company—an all-hydroelectric system—will install in its Big Bend Project near Klamath Falls, Oreg. Built by the Eddystone Division of Baldwin-Lima-Hamilton, each of these turbines is rated to produce 56,000 hp at 277 rpm under 440-ft. head.

Eddystone is also supplying two large butterfly valves for this project, and B-L-H's Pelton Division is furnishing the governors.

In addition to all four basic types of hydraulic turbines—impulse, Kaplan, Francis and propeller—Baldwin-Lima-Hamilton also manufactures governors, surge suppressors, valves, special pumps, and other accessory equipment. For additional information, write to B-L-H Corporation, Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.

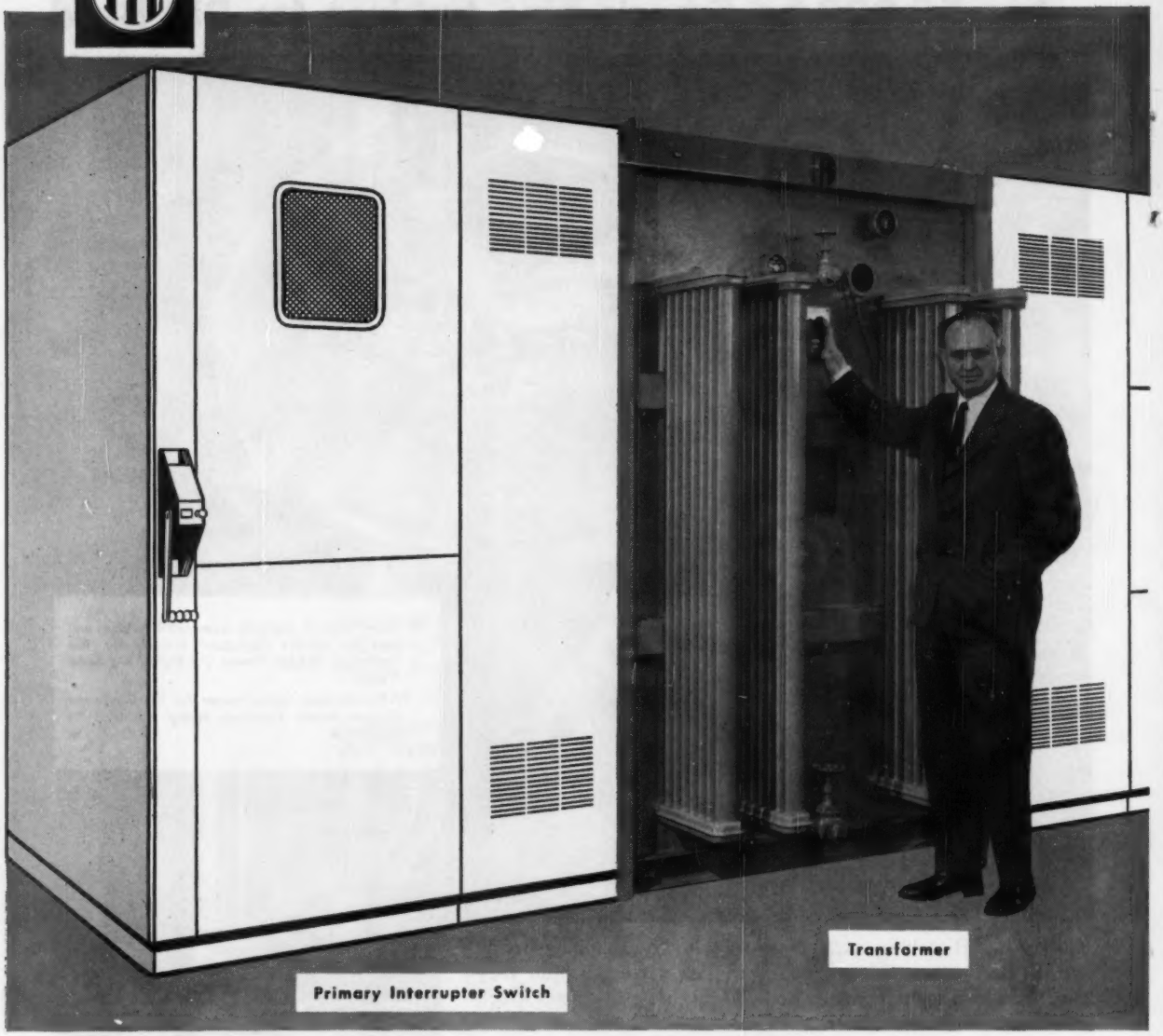
BALDWIN · LIMA · HAMILTON

Eddystone Division

Philadelphia 42, Pa.

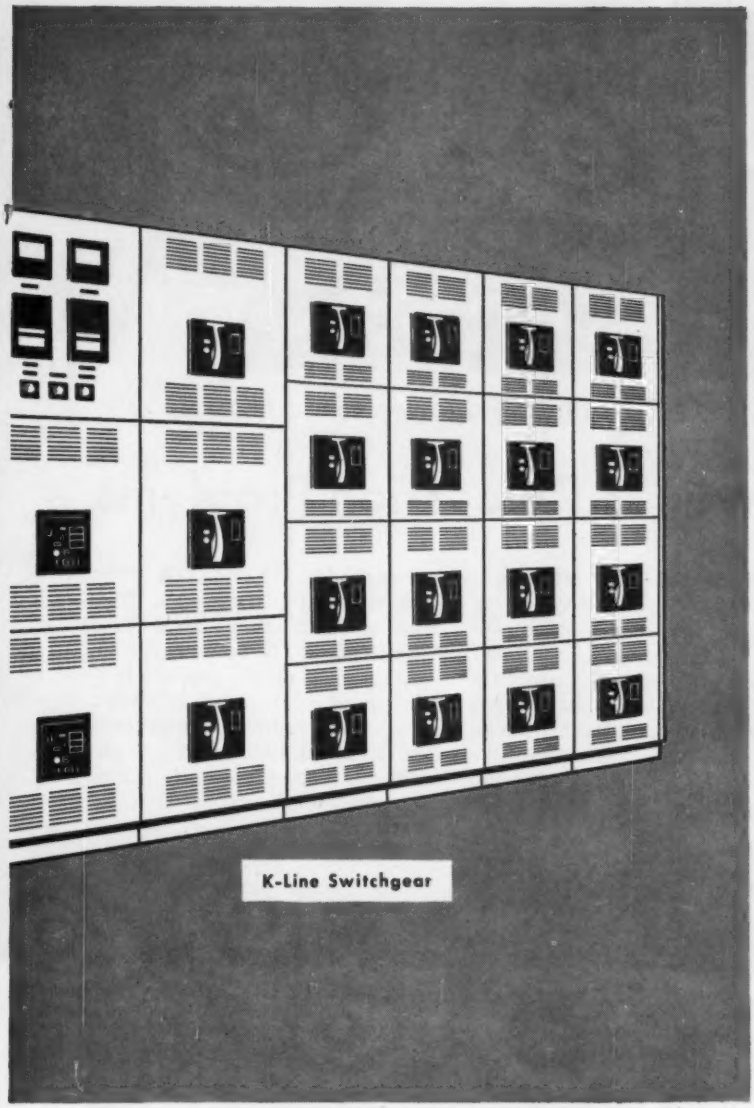
Hydraulic turbines • Weldments • Dump cars • Nonferrous castings • Special machinery • Bending rolls • Machine tools

SECONDARY UNIT SUBSTATIONS

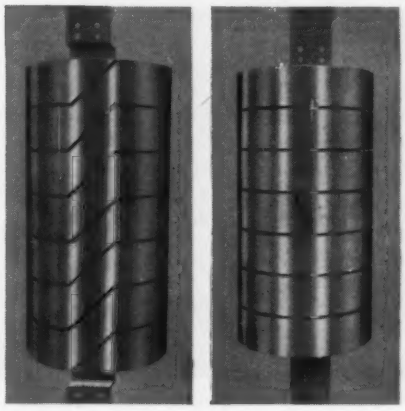


TRANSFORMERS BUILT ON FRESH IDEAS

New designs, incorporating latest ideas, insure more dependable performance, better looking units



Coils stay put. Double jackscrews in combination with tie rods between upper and lower core clamps hold coils rigidly in place, even under severest short circuit stress.



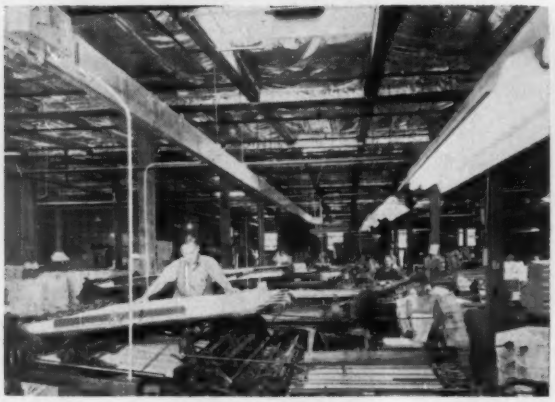
Brute strength secondaries. A fresh approach to high current secondaries for dry type transformers is this coil formed from solid copper bus. This unique design embodies great structural strength, and high conductivity.

Look what I-T-E gives you now in unit substations: transformers designed fresh from the ground up . . . incorporating developments based on the most up-to-the-minute transformer technology.

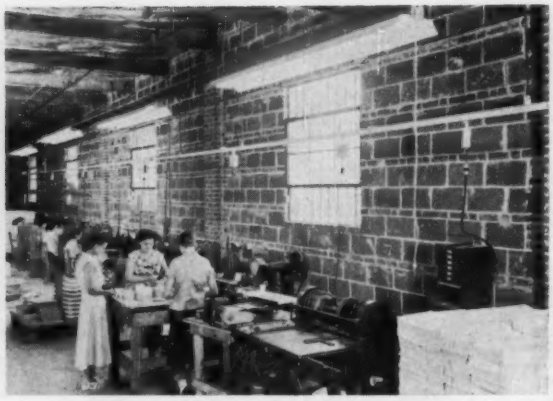
This fresh approach to transformer design and construction has produced remarkable new gains in transformer performance: greater dependability, stronger construction, more effective use of materials.

Only I-T-E offers you unit substations completely engineered and built in a single plant . . . insuring coordinated engineering, easier ordering, simultaneous delivery of all elements, simpler installation, and a single, dependable name in back of them. Write for complete details. Switchgear Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.

I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA, PENNSYLVANIA



Using bus duct for heavy machines . . .



and trolley duct for lighter ones . . .

Flexible Distribution Ends Relocation Problems

LOU ROBL, Industrial Power Representative, Baltimore Gas & Electric Co, Baltimore, Md.

Well-planned, up-to-date wiring in their new plant has eliminated the operating difficulties which plagued Graphic Arts Finishing Co, Baltimore finishers to the printing and lithographing trade, at old plant.

Overhead bus duct provides a convenient source of 240-v, 3-phase power for heavy production apparatus and permits relocation of machinery without costly changes in wiring. A 120-v, single phase trolley duct system, with outlets that can be moved along the entire length of the system, assures mobility of small production units.

Electrical facilities throughout the plant are designed for growth. New distribution circuits and capacity for bigger loads can be added easily.

At the old plant, the lack of a flexible wiring system had hampered growth and restricted production. Rearrangement of machinery to improve the flow of work was practically impossible.

Packaged Heat Pumps Eliminate Metal Marring Headache

ELMER R. BACHTELL, JR., Power Sales Engineer, South Penn Power Co, Waynesboro, Pa.

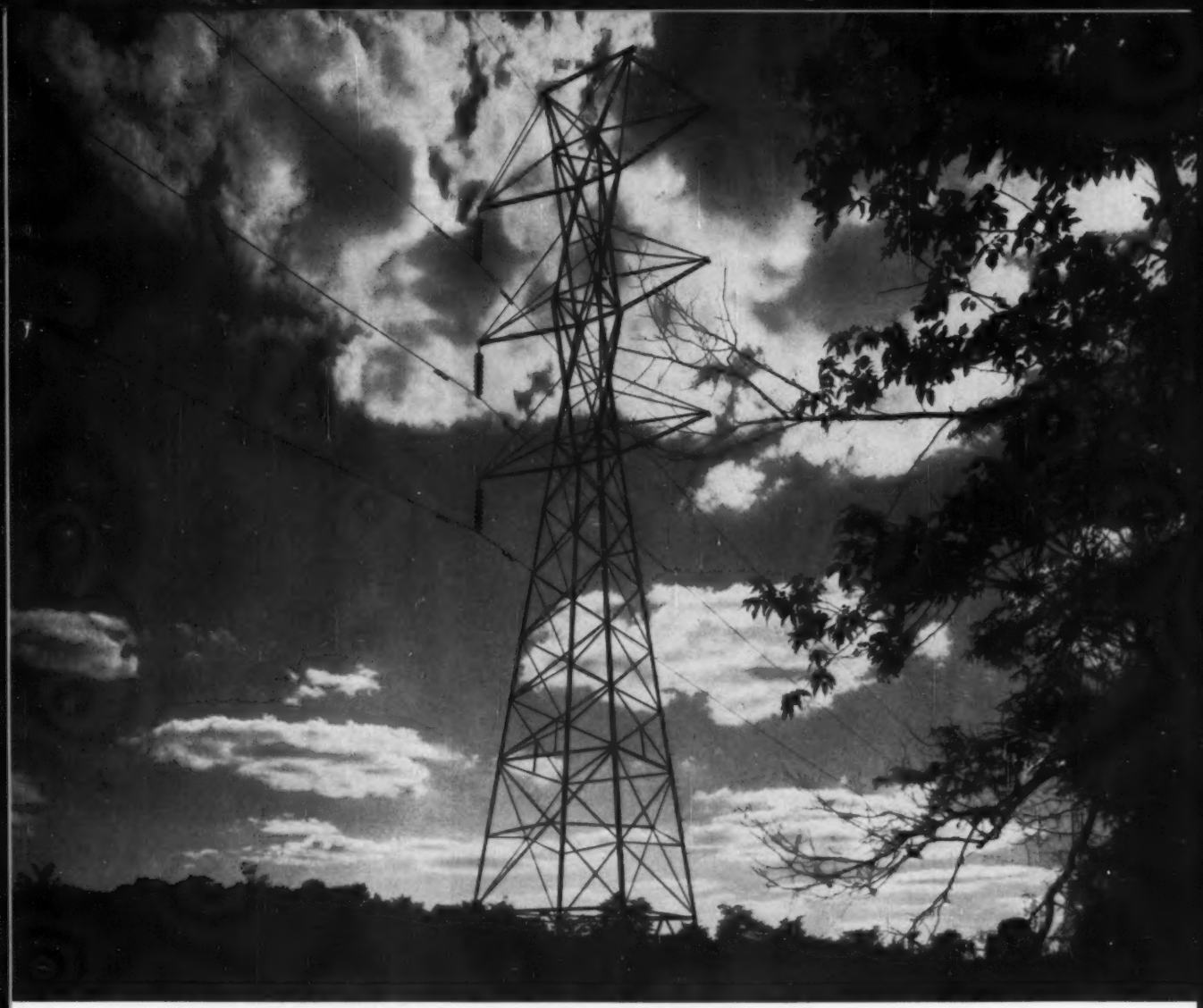
Nine 5-hp heat pumps have eliminated a problem in handling stainless steel and proven an efficient source of heating and cooling at the Emmert Manufacturing Co in Waynesboro, Pa. Before the units were installed, the company experienced persistent difficulty with marks, caused by perspiration from the employees hands, on the stainless steel used in the manufacture of engineering equipment, boards, machines, complete units, and special vises.

Another advantage of the heat pumps is the cleanliness of operation. There is a conspicuous absence of soot and the greasy, oily film usually associated with conventional heating systems.

The packaged units are located along the outside wall of the plant area, thereby eliminating the need for extensive, and expensive, duct work. Two additional units are used for heating and cooling the company offices.

One of the major factors in the selection of the heat pumps was the ability to obtain both heating and cooling from one unit. The equipment automatically switches between heating and cooling, from season to season, within the same day or even the same hour. This is one of the largest electric heating installations in the area.

(*More Selling on page* 108)



Blaw-Knox Double Circuit Tower — first circuit installed; built-in provision for second circuit when needed

To expand an existing line... to build a new line...

they chose BLAW-KNOX TOWERS

To feed the output of a new unit at the Picway Generating Station into their 138 kv system and to meet the demand in a growing residential area, Columbus and Southern Ohio Electric Company approved construction of two new transmission lines. For both lines, they chose Blaw-Knox towers.

The 138 kv line from the Picway Generating Station to Harrison Switching Station, a distance of one mile, required one 100′ single circuit tower and five double circuit towers varying from 50′ to 95′ in height.

The 10 mile, 138 kv line from Wilson Road to Bethel Road Substations is carried on 50 double circuit towers from 50′ to 85′ in height.

For more than 40 years, Blaw-Knox has worked closely with Electric Utilities in designing and fabricating towers for every type of transmission system. From this experience have evolved basic designs combining maximum structural advantages and ease of erection with unique allowances for custom modification. The performance record of Blaw-Knox Towers assures you . . .

- **towers custom designed to best meet your individual requirements**
- **high quality fabrication for easy field erection**

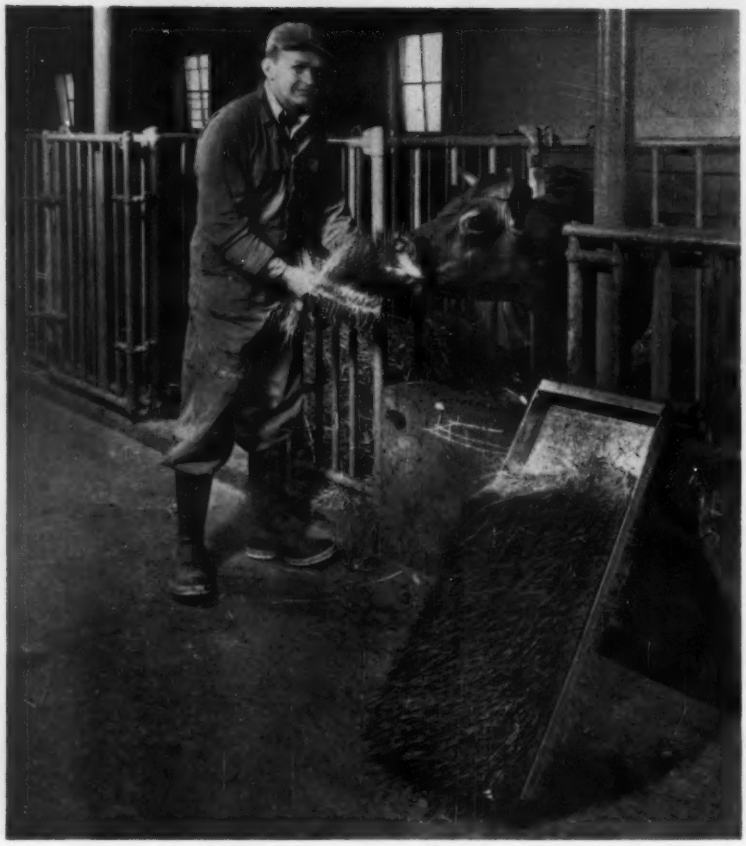
Send today for Folder 2509 . . . or tell us your needs, and we'll give you our recommendations and a quotation.

BLAW-KNOX COMPANY • **Blaw-Knox Equipment Division**
Pittsburgh 38, Pennsylvania

BLAW-KNOX

TRANSMISSION TOWERS—Steel Transmission towers, custom-built for each installation...multi-circuit and other special structures...and antenna towers, guyed and self-supporting types for AM • FM • TV • microwave • communications • radar

Heat Pump + 'Hydroponics' = Grass in 6 Days



"Hydroponics" is the science of soiless plant growth. Gene Folck, left, a dairy farmer in Springfield, Ohio, is using it and 600 kwhr to grow four tons of green grass a month to feed his herd.

Secret of the hydroponics process is a specially built seed incubator made of three power-consuming components: a 1-hp heat pump (3 kw of resistance heat in winter); two banks of infra-red lamps, each with eight lamps; and a ¼-hp recirculating water pump. The unit is made by Buckeye Corp, Springfield, Ohio. Sixty growing trays in it produce about a ton of grass a week, enough for a herd of 25 Holsteins or 30-35 Jerseys.

The advantages of the incubated hydroponic system:

- Farmers are able to feed green grass to herds throughout the year, regardless of weather.
- It protects cattle from swallowing harmful foreign matter (rusty nails, glass, etc.) while grazing.

What about costs?

Initial cost of the 60-tray unit is about $2,900. Operating cost, including seed, power and labor average between $12-$14 a ton, depending upon local kwhr rates.

How a Combination Company Sells Electric Heat

H. T. HUFFMAN, Promotion Manager, South Carolina Electric & Gas Co, Columbia, S. C.

How does a combination utility promote electric heating?

Probably there is no blanket answer which would be satisfactory for all the combination companies around the country, but here are the whys and wherefores of the matter for South Carolina Electric & Gas:

We are a combination company headquartered in Columbia, S. C. Our total service area is 12,025 sq mi, and we enjoy an average of 2,200 deg-days. We serve 149,648 residential customers who have an average annual use of 4,484 kwhrs. In 1957 our summer peak was 3.4% greater than our winter one. This summer peak has been rising due to an avalanche of air conditioning load during the past few years. We decided to get into the electric heating business to counteract this situation. Here's what we did . . .

1.69¢ Rate + Bonus Are Tools

First, we had to overcome the psychology typified by one customer's remark, "Look, electric heating is just too darned expensive!" This we have been doing by offering the heat at 1.69¢ per kwhr. This is competitive with 7¢ gas (therm) and 15¢ oil (gal.) in our service area.

As an added inducement, we decided to pay a cash bonus to customers of $2.00—cash on the line—for each 1,000 Btu of heating installed. For our own protection, we stipulated that (1) electricity must be the sole method of heating; and (2) a minimum of 10,000 Btu/hr (3 kw) must be installed. Furthermore, only permanent, UL-approved equipment is allowed; bonuses did not apply to portable heaters. In the case of heat pumps, we furnished a

chart showing the Btu output; this is the basis used for calculating the bonus. Supplementary resistance heaters in the heat pumps do not count.

We are also stressing insulation, using the accepted 6-4-2 formula (Six in. in ceiling; four in. in walls; and two in. in floors above uninsulated spaces). Zone control and "selected area or room heating" are primary selling points with us.

Advertising-wise, our program went like this:

- First ad, a "softener", broke in local papers Jan. 19.
- Bonus announcement ads ran Feb. 9 and 10 and then repeated Mar. 2 and 3.

What have the results been? The program is less than six months old, and results to date, although not definitive, stack up like this:

- 21 complete resistance heating installations.
- 40 complete heat pump jobs.
- 677 total kw connected.
- 17,743 estimated EAR.

These results have been encouraging, and although the heating season for '58 is about over, we expect the trend toward electric heating to continue. Nobody's going to tell us it can't be made to pay for a combination company.

We know different.

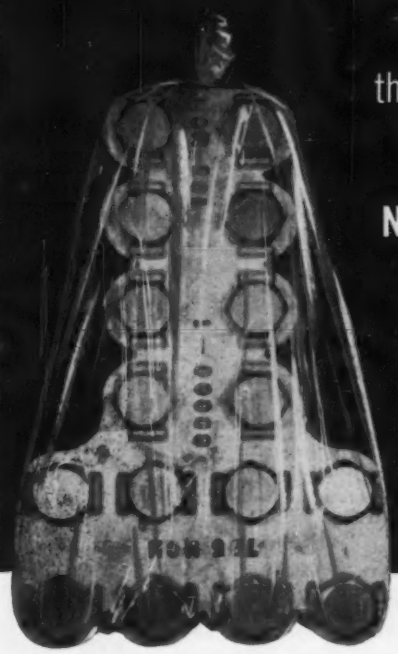
HL&P Offers Full Refund in Electric Range Campaign

Complete satisfaction with electric cooking or a full refund is the talking point in a 61-day concentrated sales push on electric ranges by Houston Lighting and Power Co, under the slogan, "You'll love electric cooking . . . or your money back!"

Within 30 days following installation the customer must receive a range demonstration by a HL&P home economist and use the range herself. If she is not completely satisfied, the dealer will refund the full purchase price, together with the actual wiring-in cost, up to a maximum of $70. This is the first time HL&P offered such a guarantee.

Advertising support will include newspaper ads, 36 posterboards, 740 truck signs, all backed by 2,000 radio spots on 10 stations.

IT'S IN THE BAG



the finest aluminum power connector ever made... NOW PACKAGED to insure positive, dirt-free contact surfaces

Every aluminum connector in Royal's outstanding new line is now *individually packaged* in its own polyethylene bag immediately after the oxide inhibitor is applied. From manufacture to installation, *not one* speck of dirt or foreign matter can reach the contact surface—you get *full* conductivity, always. This is another example of the "Royal" treatment.

The new aluminum connectors themselves have *exclusive* HEAVY-SERIES BOLT CONFIGURATION for *highest* clamping force with *lowest* connector stress.

Get all the facts in Royal's new Aluminum Connector Catalog No. 1. You'll see over 150 different types, more than 7500 new items — and it's sectioned and tabbed for fast selection. A special section contains tables, charts and valuable engineering information . . . plus estimating and planning helps. Write Royal on your company letterhead today.

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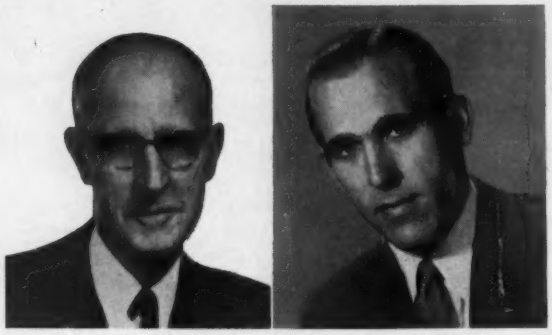
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

Missouri PS Has New President and Chairman



R. J. GREEN R. C. GREEN

Richard C. Green has been named to succeed his father, Ralph J. Green, as president of Missouri Public Service Co. Ralph Green now becomes board chairman.

Richard Green, whose grandfather founded the utility in 1917, has been serving as executive vice president for the past eight years. He is also a trustee of Southwest Atomic Energy Associates and a member of the executive committee, Missouri Valley Electric Assn.

Ralph Green, president of the utility since 1940, has specialized in utility financing, plant and property, and general operations during his long utility career. In his new capacity he will continue to participate actively in company affairs.

Pacific G&E Ups Three to VP Positions

Shermer L. Sibley has been named vice president-general manager of Pacific Gas & Electric Co. In addition, Arthur J. Swank rose to VP-electric operations and Herbert W. Haberkorn to VP-general construction.

Sibley has been VP-assistant general manager for three years. The general manager's duties had been performed by Pres N. R. Sutherland since 1950.

Swank, who replaces retiring George A. Peers, has been VP-general construction since 1953.

Haberkorn is former manager of hydroelectric construction and a veteran of 37 years with PG&E.

SIBLEY SWANK HABERKORN

KOCH PERSON VIRTUE REED MILLER

Five Executives Are Promoted by Colorado PS

Three new executive vice presidents—M. M. Koch, R. T. Person, and W. D. Virtue—and two new vice presidents—O. P. Reed and D. J. Miller—were elected at the recent meeting of the board of directors of Public Service Co of Colorado.

Koch becomes executive vice president in charge of electric operations. A long-time PSC employee, he most recently was vice president.

Person, a vice president since 1956, now rises to executive VP of advertising and publicity. Before joining PSC in 1953, he was vice president-general manager of Pueblo Gas & Fuel Co, a subsidiary.

Virtue, as executive VP, retains his position as company treasurer.

Reed, manager of employee relations since early 1957, will continue these duties as vice president. He previously was VP-general manager of Cheyenne Light, Fuel & Power Co, a wholly-owned subsidiary.

Miller, as new VP-gas operations, succeeds retiring F. T. Parks.

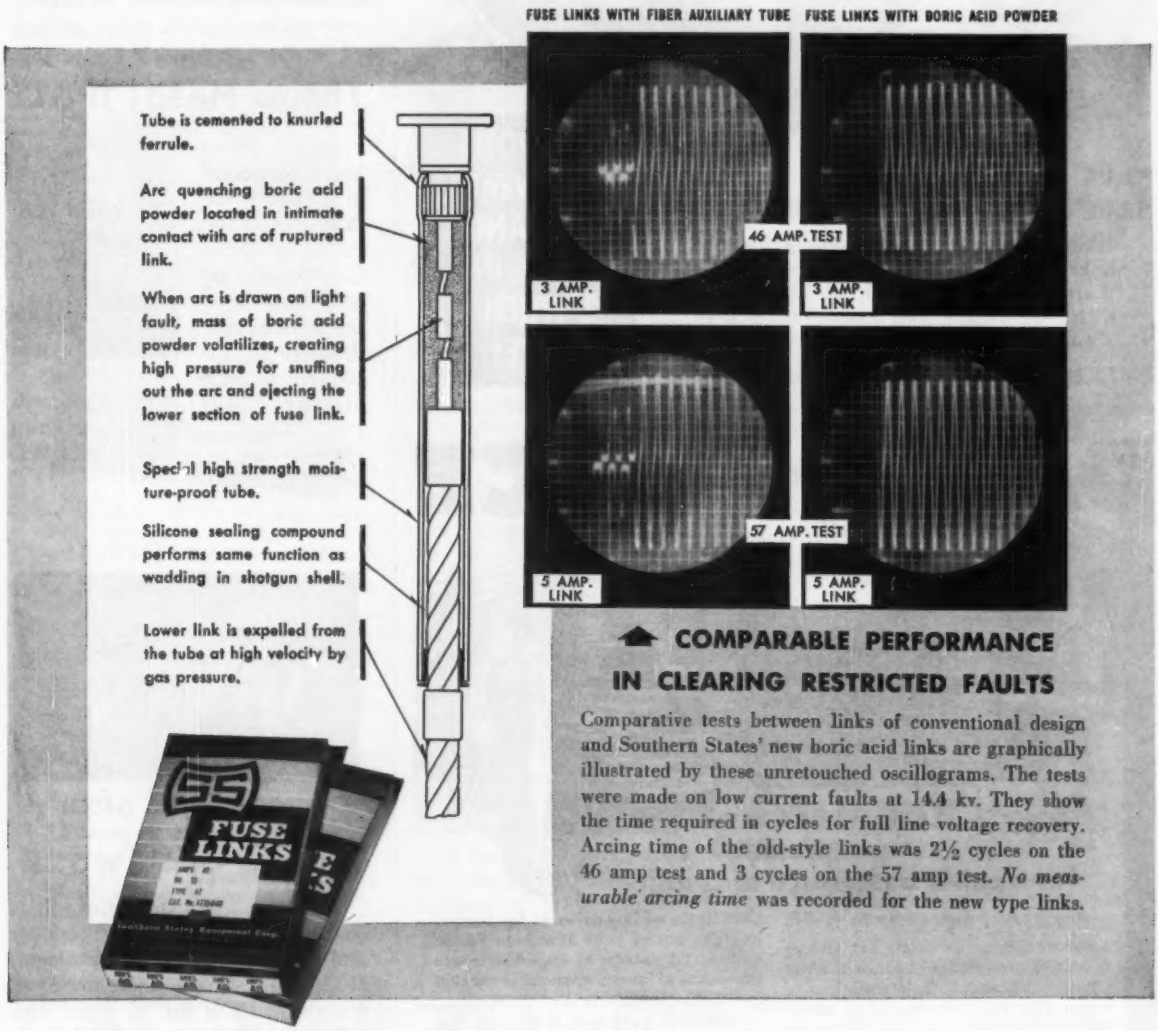
SOUTHERN STATES FUSE LINKS SOLVE PROBLEM OF LOW FAULTS

The problem of clearing restricted faults can be effectively eliminated by using Southern States boric acid fuse links. Even when using large bore cutouts, a low-magnitude fault can be cleared with little arcing.

As the illustration below shows, boric acid powder is in intimate contact with the fusible element. When the link ruptures, the mass of boric acid volatilizes, building a vapor pressure high enough to quench the arc instantly.

The added protection afforded by boric acid links virtually eliminates the possibility of cutout failure when called on to operate in the low current range.

Standard construction features of these links include: silver plating of all external metal parts . . . high-strength crimped joints . . . low-melting temperature elements . . . and moisture-resistant auxiliary tubes. You get a stronger link, more resistant to corrosion, and more dependable than ever.


Tube is cemented to knurled ferrule.
Arc quenching boric acid powder located in intimate contact with arc of ruptured link.
When arc is drawn on light fault, mass of boric acid powder volatilizes, creating high pressure for snuffing out the arc and ejecting the lower section of fuse link.
Special high strength moisture-proof tube.
Silicone sealing compound performs same function as wadding in shotgun shell.
Lower link is expelled from the tube at high velocity by gas pressure.
FUSE LINKS WITH FIBER AUXILIARY TUBE
FUSE LINKS WITH BORIC ACID POWDER
46 AMP. TEST
3 AMP. LINK
3 AMP. LINK
57 AMP. TEST
5 AMP. LINK
5 AMP. LINK
FUSE LINKS

COMPARABLE PERFORMANCE IN CLEARING RESTRICTED FAULTS

Comparative tests between links of conventional design and Southern States' new boric acid links are graphically illustrated by these unretouched oscillograms. The tests were made on low current faults at 14.4 kv. They show the time required in cycles for full line voltage recovery. Arcing time of the old-style links was 2½ cycles on the 46 amp test and 3 cycles on the 57 amp test. *No measurable arcing time* was recorded for the new type links.

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

Over 100,000 WARN HUBS now in use on 4-wheel drives!

Models for all makes 4 w. ds. to 1½ tons at local dealers'.

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Install either Warn Lock-O-matics, the hubs that "shift for themselves", or get Warn Locking Hubs and "dial the drive" with your fingers. You'll never again have a 4-wheel drive without Warn Hubs!

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PAGE will help you to choose the RIGHT fence for YOU from a wide variety of fence styles and four superior fabric materials—including the new ACCO Aluminized Fabric. For information and name of nearest Association member, write for Folder DH-26.

Address: **PAGE FENCE ASSOCIATION**
National Headquarters • Monessen, Pa.

A PRODUCT OF PAGE STEEL & WIRE DIVISION, AMERICAN CHAIN & CABLE COMPANY, INC.

Clawson Advances

J. H. Clawson has been elected vice president of Puget Sound Power & Light Co. He will continue as treasurer, a position he has held since 1947.

A former auditor for Stone & Webster, Inc, he joined PSP&L in 1933. Since then he has also been assistant treasurer and controller.

Thams Heads IP&L

Leo Thams has been elected as the new president of Inland Power & Light Co, Spokane. He had been serving as vice president since the cooperative was organized in 1937. Thams succeeds D. I. Hopkins, who stepped down after serving as president of IP&L for 21 years.

OSBORNE GASCH

PINCO Ups Two

Porcelain Insulator Corp has elected D. H. Osborne as president and R. H. Gasch as vice president.

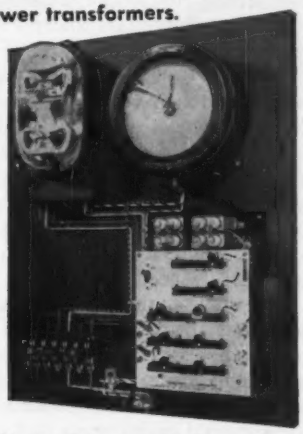
Osborne has been a vice president for about 15 of his 30 years with PINCO. He holds National Electrical Manufacturers Association's coveted award for 50 years continuous service in the electrical industry.

Gasch, until this appointment, was vice president of Joslyn Manufacturing & Supply Co and general manager of three of its divisions.

Transformer Loss Compensator

Saves you Money!

BECAUSE it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the power transformers.



This installation at 2.3 kv saved about $2600 compared with 34.5 kv metering; it saves about $5500 over metering at 69 kv.

THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced in two and three element types for use with two-element or three-element meters on any type circuit.

Some of the Users . . .

Phila. Electric Co. Penna. Power & Light Co. Texas Power & Light Co. U. S. Bureau of Recl. Public Service Co. of New Hampshire. Utah Power & Light Co. Northern States Power Co.

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Claus Named VP

Babcock & Wilcox Co has elected Carl Claus as a vice president. In this capacity, he will continue to direct the activities of the Staff Division, which provides essential services to all company divisions. He has been Staff Division director since 1955.

SHEETS McCAMPBELL GOOD

S&W Elects VP's

At Stone & Webster Engineering Corp, W. L. Sheets, H. N. McCampbell, and Arthur J. Good have risen to vice presidential positions.

Sheets, a former construction manager, previously served as resident and project engineer.

McCampbell, construction manager since 1953, has held responsible engineering posts during his 38-year S&W career.

Good is former comptroller. He has also held various engineering and administration positions.

PERSONAL BRIEFS

Virginia Electric & Power Co has appointed **Walter J. Matthews** operating manager and **A. LeRoy Jameson** general sales manager. Matthews replaces A. H. McDowell, Jr, recently elected VEPCO president (EW, May 5, p 104).

Joseph Pirtz, Jr, is new manager of hydroelectric construction for Pacific Gas & Electric Co . . . Indianapolis Power & Light Co has elected **George F. Switzer** assistant vice president-engineering and construction . . . **J. F. Delage** has been advanced to assistant chief system operator by Gulf States Utilities Co.

KLEIN

preferred by linemen . . . electricians

The name Klein on leather goods is known and preferred by linemen and electricians everywhere. Klein tool belts, safety straps, pouches and pockets represent the highest in quality, the safest in design and construction.

In safety straps, Klein-Kord was the first specially woven fabric strap designed to permit the use of a tongue-type buckle without risk of slitting or ripping, even under severe strain.

Now Nylon Klein-Kord safety straps are the newest Klein development offering maximum safety with maximum flexibility. These are the only nylon straps designed to meet the tests given in Edison Electric Institute Report AP-2.

Free Tool Guide

A copy of the new Klein Pocket Tool Guide will be sent on request.

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Federal Rate Rise Foreseen

A rise in the basic wholesale federal power rate appears likely, Dr W. A. Pearl, Bonneville Power Administration administrator, told the April meeting of the Northwest Public Power Association at Spokane, Wash. Reiterating BPA's warnings of such a possibility over the past eight years, Pearl declared that the federal system will be in the red in the fiscal years 1958 and 1959. Although rate revisions are unlikely before Dec 1959, they are under careful study now, he said.

BPA managed to retain its basic $17.50 per kwhr wholesale rate in recent years only through better than median water conditions, heavy sales of interruptible energy, technological advances in transmission, and projects completed at costs substantially lower than original estimates.

But recent loss of all interruptible and some firm load through cutbacks in the aluminum industry, reduced sales due to warm weather, and some general effects of the present recession have combined with recent higher project costs to negate BPA's former advantages, he said. Pearl noted that a proposed E-5 rate, a single demand-energy rate that would supersede several variously structured rates now operative, has been presented to BPA customers for comments.

E. W. Moke, BPA rate analyst, told the meeting that the proposed rate was designed to maintain relative price relationships now existing among customer groups.

Shades of Hells Canyon

Rejection of Pacific Northwest Power Co's Mountain Sheep-Pleasant Valley application by the Federal Power Commission was influenced by public power's stand in the Hells Canyon case, said Alex Radin, American Public Power Association's general manager. "FPC's contentions," he said, "bore too much resemblance to the arguments in favor of high Hells Canyon to be mere coincidence."

Nevertheless, the federal government has been "abdicating" its leadership in multi-purpose river development, Radin said, noting that Congress had not distinguished between capital investments and normal operating expenditures. But such proposed legislation as the TVA self-financing and the NPPA-drafted Columbia River Development Corp bill, he added, could remedy the situation by creating capital budgeting systems.

Sen Henry M. Jackson (D-Wash.) told the NPPA that Russia's strategy is to best the U. S. in industrial might rather than in hot war. If its growth rate continues, the U.S.S.R. will forge ahead in electric power production in the '70's, he said, and is now building one dam triple Grand Coulee's rating and nine more at least Coulee's size. He urged immediate prosecution of the comprehensive development of upper Columbia and middle Snake reaches.

The Joint International Commission on the upper Columbia development, Jackson declared, is impotent for settling present outstanding differences. He advocated a continuously functioning body formed by Pacific Northwest states for taking over American negotiation.

"VOLT-TELLING STATISCOPE" protects worker

. . . when held in any alternating electrical field. Indicates presence of voltage in AC and Pulsating DC Circuits and in various electrical apparatus. . . . Pocket-size illustrated above, also in Station and Overhead Extension types. Thousands in use. Order from Electrical Jobber. Send for new literature.

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KNIFE-TYPE, REMOVABLE LINK & SLIDE-A-LINK SWITCHES
METER DEVICES
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The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

SALES ASSIGNMENTS

COMPANY STAFFS

Collyer Insulated Wire Co has appointed William M. Selig sales representative in the New England area, with headquarters in Newton, Mass.

Copperweld Steel Co has named Gerald D. Sewick as sales engineer for the Wire and Cable Division. Working from Chicago headquarters, he will cover northern Illinois, lower peninsula of Michigan, and parts of Indiana, Iowa, and Wisconsin. Gordon Cavanagh, who formerly held Sewick's post, has advanced to development engineer, concentrating on Alumoweld.

Graybar Electric Co, Inc, has named J. A. Kirk as manager at Sioux Falls in the Minneapolis district. R. K. Jenson becomes manager at Duluth.

Reynolds Metals Co has appointed Ira F. Endres, Jr, as northeast regional electrical conductor sales specialist. He will coordinate sales of aluminum electrical conductor wire, cable, and electrical fittings in New York, northern New Jersey, and the New England states.

Riley Stoker Corp has named Harry W. Moore, Jr, as district manager of its new Syracuse (N. Y.) sales office. The new office will consolidate sales activity of steam generating and fuel burning equipment for industrial and public utility plants formerly handled at the firm's Buffalo office.

Rome Cable Corp has added Lawrence R. Hennings to the staff of its Seattle, Wash., sales office.

Sylvania Electric Products, Inc, has designated Barry E. Colby as Philadelphia district sales manager for Sylvania Lighting Products, a division. Howard J. Martin, who formerly held that post, assumes new special accounts sales responsibilities . . . John F. Dill is new district sales manager at Milwaukee for the lighting products component.

Weston Instruments, a division of Daystrom, Inc, has named Erwin T. Higgons as manager of the Milwaukee district sales office.

Guidance pays!

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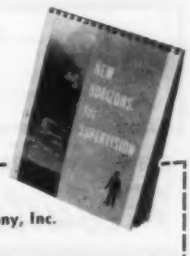

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The English Electric Company of England is actively engaged in the design and construction of the largest Atomic Power Station in the world. This is one of the few commercially sound Nuclear Power Stations now being built for the generation of electrical power.

Engineers, physicists & mathematicians who are interested in this work or who are interested in being trained for such work are invited to send details of their experience and qualifications to the address given below.

It must be stressed that these interesting openings are intended for people with the highest academic and technical qualifications.

Selected applicants will be interviewed by the Chief Engineer of the Atomic Power Division of the English Electric Company at centers in the United States during June and at these interviews full details will be given of the salaries, excellent conditions of employment and additional allowances to make this work in Britain an outstanding opportunity.

Send resume to: MR. STANLEY DEAN

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A subsidiary operating in Sicily (Italy) has a career position for a Pipeline/ Electrical Engineer, age limit to 40 years, with the following qualifications:

EDUCATION: B.S. in Electrical Engineering from an accredited institution.

EXPERIENCE. Diversified experience in design, installation, operation & maintenance of power generation at 3000 volt level. Facilities include saturated steam plant; high & low voltage switch gear, motors & controls; high voltage transmission & low voltage distribution systems; pneumatic instrumentation; FM radio. Maintenance of 20,000 volt distribution system & step-down transformer banks.

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Electrical Superintendent—Graduate electrical engineer or equivalent, preferably registered, to take charge of electrical distribution and steam generation for municipal operation in southern Pennsylvania college town of 20,000. Attractive salary, good working conditions, pleasant living, job security, non-political. Send full resume, including references, to P-7697, Electrical World.

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Engineer, Power generation and Distribution with Consulting Firm or Utility. Education: B.S. Mechanical Engineer, Registered, extra courses electrical; Experience: Twenty years, diversified in design, installation, operation and maintenance generation and distribution. Present manager and Engineer system 11,000 meters. Age 48, married, three children, good health. PW-7946, Electrical World.

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British manufacturer with moulding and light engineering facilities and Television, Radio & Electrical technical staff, would be interested to discuss producing good sales lines for British market with progressive American manufacturer. RA-7885, Electrical World.

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3—400 H.P. Ingersoll-Rand PVG Gas Engines, 400 R.P.M. direct connected to

3—250 KW Electric Machinery Co., A.C. Generators @ 400 R.P.M., 80% P.F., 3/60/480 Volts, Belt Driving, 7½ KW Exciters 1750 R.P.M., 125 Volts complete with switchboards. Used, Good Condition.

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The Meetings Calendar

MAY

Northwest Electric Light & Power Association—Business Development Section, Advertising & Public Relations Committee and Rate Research Committee, Rainbow Hotel, Great Falls, Mont., May 19-21.

American Welding Society—Spring Technical, National & Welding Show, Hotel Schroeder, Milwaukee, Wisc., May 19-23.

Instrument Society of America—Power Division, Henry Hudson Hotel, New York City, May 21-23.

• **Southeastern Electric Exchange**—Accident Prevention Committee, Hotel Barringer, Charlotte, N. C., May 22-23; Industrial Power Sales Conference, Edgewater Gulf Hotel, Gulfport, Miss., May 29-30.

• **Edison Electric Institute**—Accounting Division Orientation Meeting, Headquarters, New York City, May 23.

• **Wisconsin Utilities Association**—Accounting Section Convention, Lake Lawn Lodge, Delavan Lake, Wisc., May 25-27.

JUNE

• **National Telemetering Conference**—Lord Baltimore Hotel, Baltimore, Md., June 2-4.

National District Heating Association—49th Annual Meeting, French Lick-Sheraton Hotel, French Lick, Ind., June 2-5.

Northwest Electric Light & Power Association—Account & Business Practices Section, Olympic Hotel, Seattle, Wash., June 4-6.

• **Conference Internationale des Grands Reseaux Electriques**—17th Convention on Large Electric Systems, Paris, France, June 4-14.

• **Electrical World**—Third Electric Space Heating and Heat Pump Conference, Barbizon-Plaza Hotel, New York City, June 5-6.

Public Utilities Association of the Virginias—Accident Prevention Conference, Hotel Roanoke, Roanoke, Va., June 6.

• **Electric Companies Public Information Program** — Inter-Regional and Steering Committees, Boston, Mass., June 8.

National Association of Electric Distributors—Annual National Convention, Civic Auditorium, San Francisco, Calif., June 8-12.

Edison Electric Institute—26th Annual Convention, Boston, Mass., June 9-11.

• **Fourth International Automation Exposition and Congress**—New York Coliseum, New York City, June 9-13.

• **The American Society of Mechanical Engineers**—Semi-annual Meeting, Statler Hotel, Detroit, Michigan, June 15-19.

• **Michigan Electric Association**—Annual Convention, Grand Hotel, Mackinac Island, Mich., June 22-25.

American Institute of Electrical Engineers—Summer General Meeting, Buffalo, N. Y., June 22-27.

• **The American Society of Testing Materials**—Annual Meeting, Statler Hotel, Boston, Mass., June 22-27.

JULY

• **National Housewares and Home Appliance Manufacturers Exhibits**—Auditorium, Atlantic City, N. J., July 7-11.

• **Colorado Farm Power Council** — Electric House Heating School, co-sponsored by Colorado State University Agricultural Engineering Department, Colorado State University, Fort Collins, Colo., July 10-11.

• **Western Summer Radio-Television & Appliance Market**—Western Merchandise Mart, San Francisco, Calif., July 21-25.

• Additions this week.

MORE BIG DATES FOR '58

National Electrical Manufacturers Association—Annual Meeting, Atlantic City, Nov. 10-14.

National Association of Railroad and Utilities Commissioners — Annual Convention, Westward Ho Hotel, Phoenix, Ariz., Nov. 17-20.

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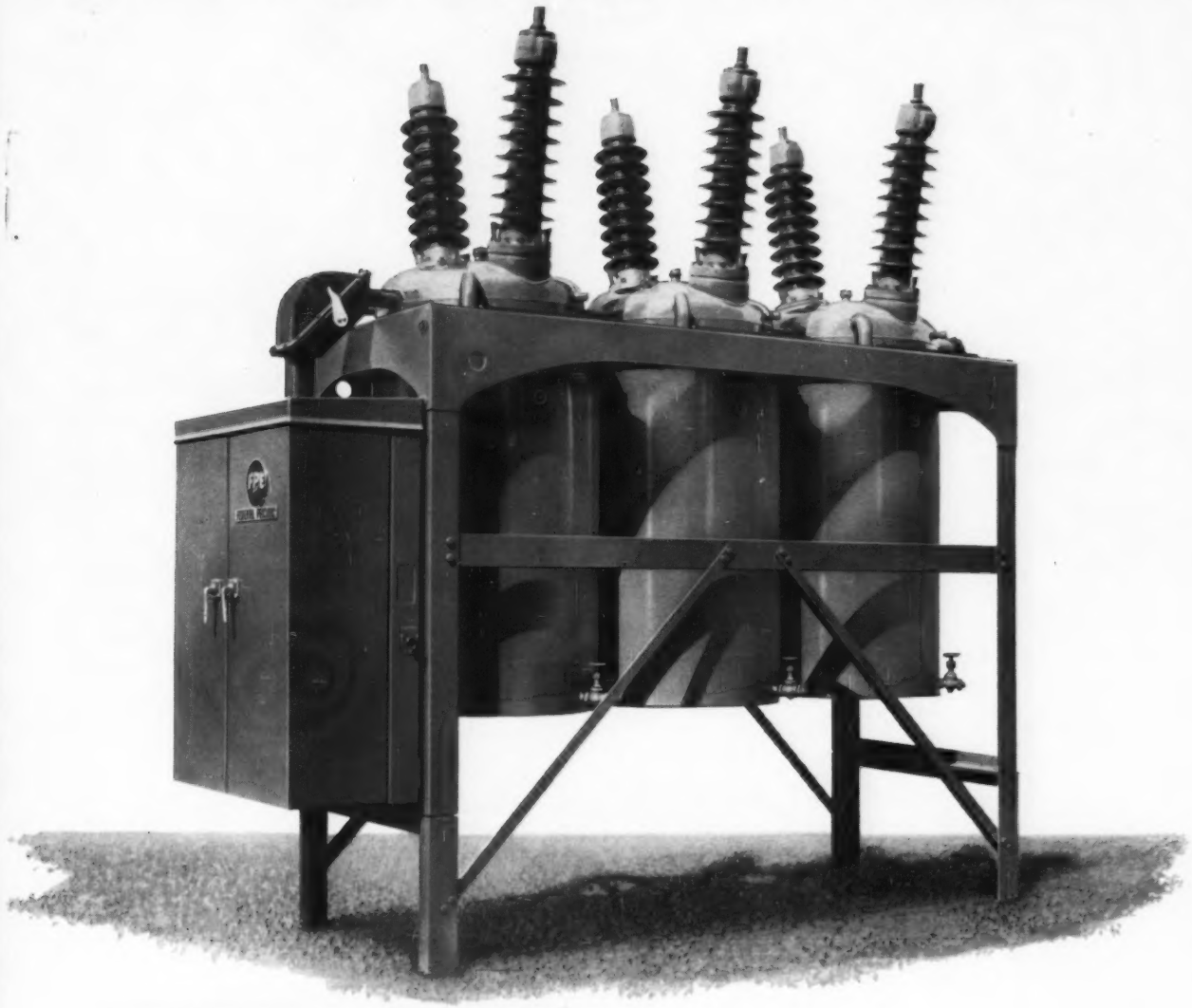

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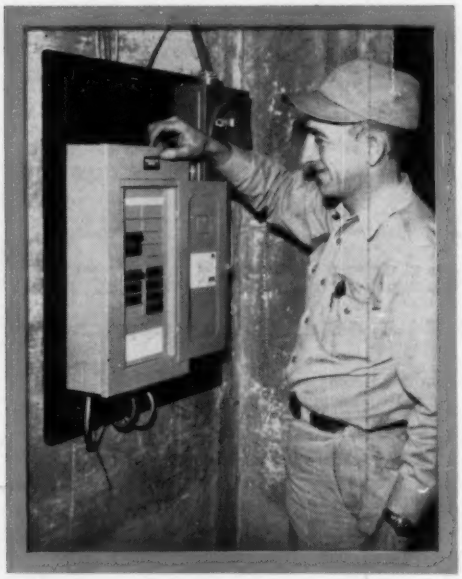
J. Roscoe Furber (right), general sales manager, shows chart on KWH increase in rewired homes to Carl T. Bremicker, NSP vice president in charge of sales. Trophy was awarded the utility in 1957 for its outstanding wiring program by Look magazine.

KWH use in rewired homes rises 20.4%, reports Northern States Power; over 5,000 jobs sold in '57



Contractor modernizes customer's wiring. Home is now safely wired for all present and future appliances.

"A 20.4% increase in customers' electric utility use isn't to be sneezed at," says J. Roscoe Furber, Northern States Power Company's general sales manager. "And that's just what we found when we made a year-long study of 978 typical HOUSEPOWER rewirings in the Minneapolis-St. Paul area, as compared with a like number of neighboring homes which were not rewired."

Approximately 40% of the rewired homes added a major appliance during the year, the utility found; most of the others made greater use of their present appliances. And, the utility points out, every HOUSEPOWER customer is a top prospect both for additional appliances now and for any new appliances which come on the market.

NSP's active promotion of full HOUSEPOWER helped sell over 5,000 rewiring jobs in 1957, an increase of 50% over 1956, when the program began. Average annual increase of electrical use for rewired homes over neighboring homes was 541 KWH, or almost seven times the rate of increase shown by neighbors who did not rewire.

"The HOUSEPOWER program offers utilities a wonderful opportunity to increase their profits while helping their customers enjoy electrical living at its finest," says George Fluehr, Kuhlman Electric Company president.

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